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CONSTRUCTION

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ENGINEERING · AND · CONTRACTING
INTERESTS · OF · CANADA



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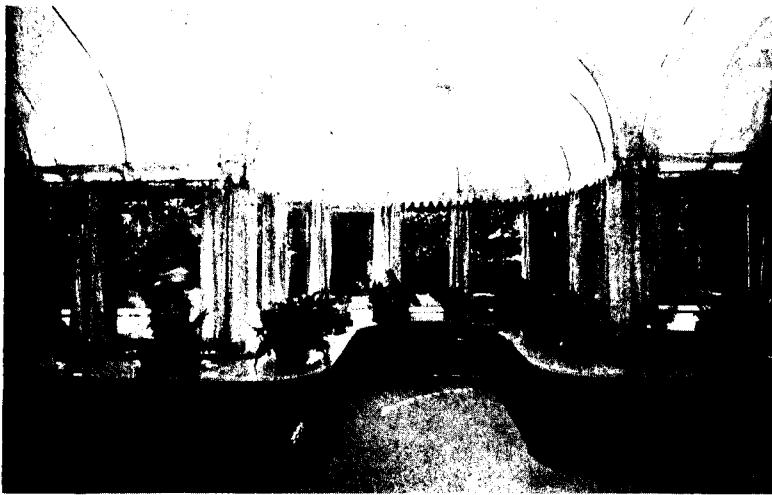
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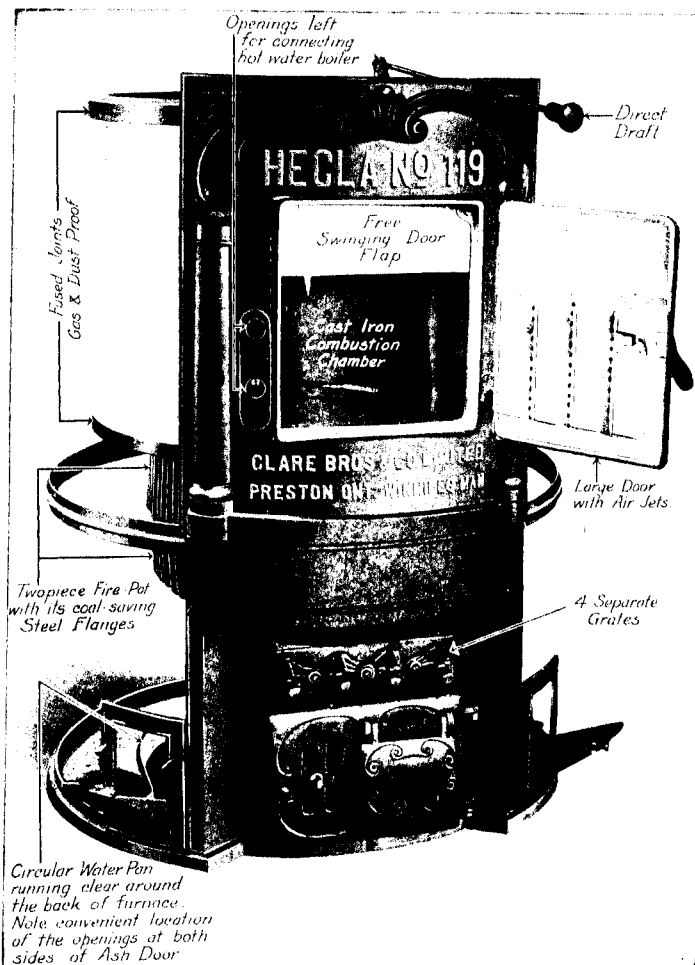
Garage and greenhouse link-up of Mr. J. D. Chapman, St. Catharines, Ontario.



The J. W. Jalbert residence conservatory at Montreal.

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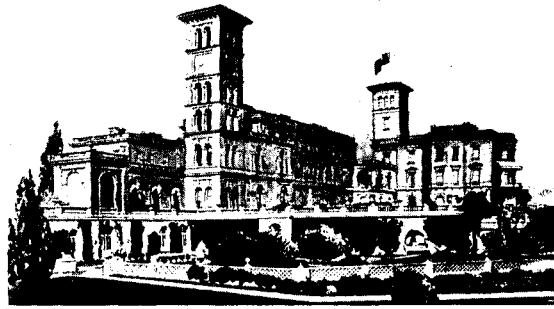
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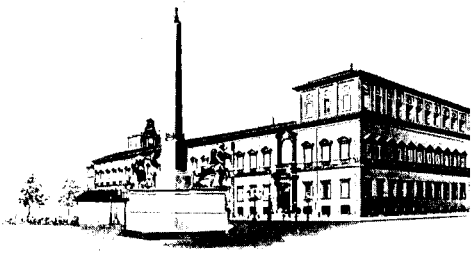
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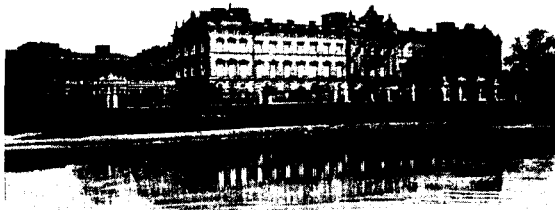
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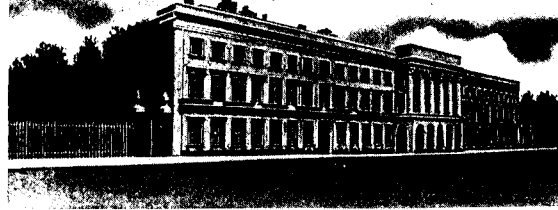
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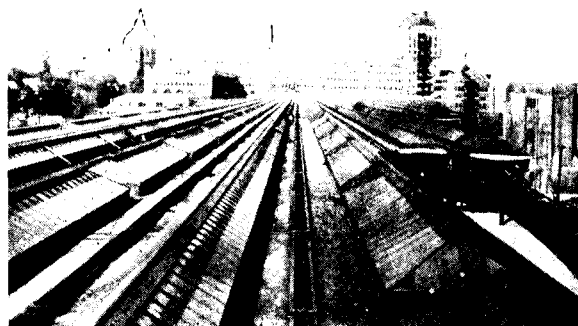


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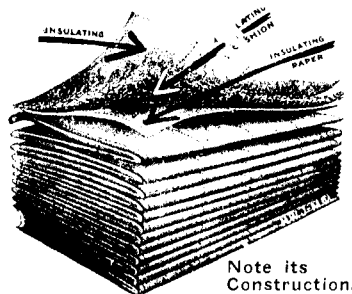
When built up in three- or five-ply laminations, these fabrics become a permanent homogeneous roof, strong enough to withstand all roof strains without depending upon any extraneous covering material, such as slag, or gravel. It is light, smooth-surfaced, water-proof, fire-retardant and permanent without coating or painting. Its fire-resistive character is attested by the fact that it is

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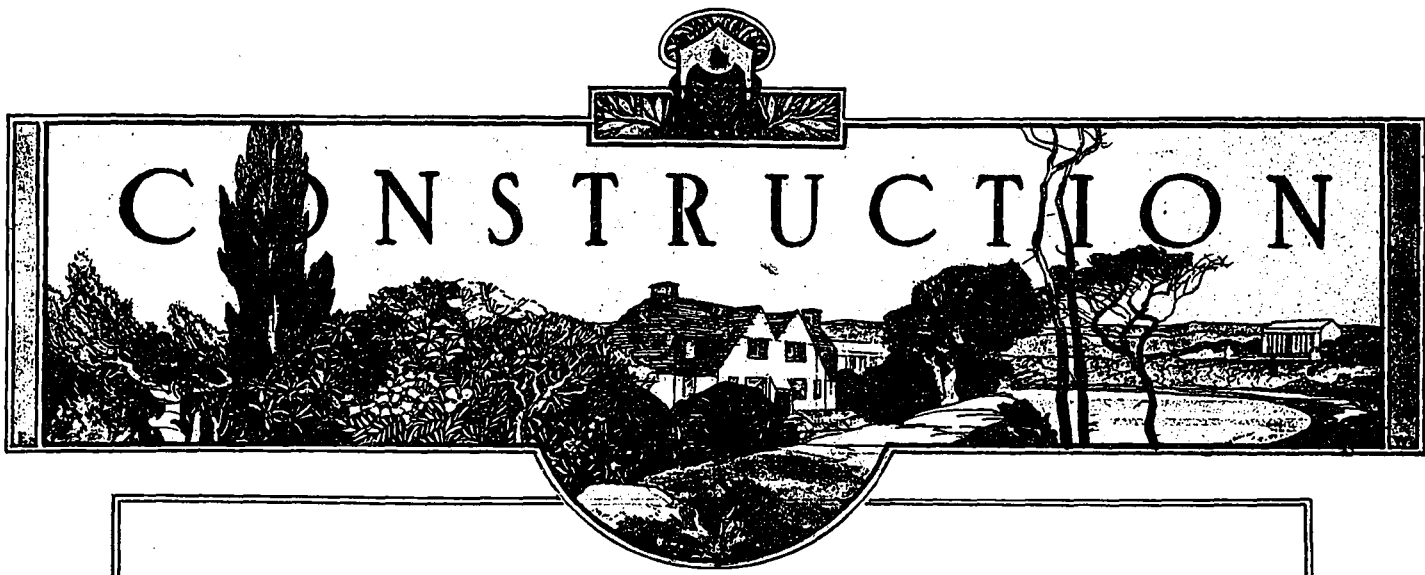
Montreal

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MAIN PORTAL OF THE MACHINERY HALL
AT THE PANAMA-PACIFIC INTERNATIONAL
EXPOSITION, SAN FRANCISCO, CALIFORNIA.



September, 1915

Vol. 8, No. 9

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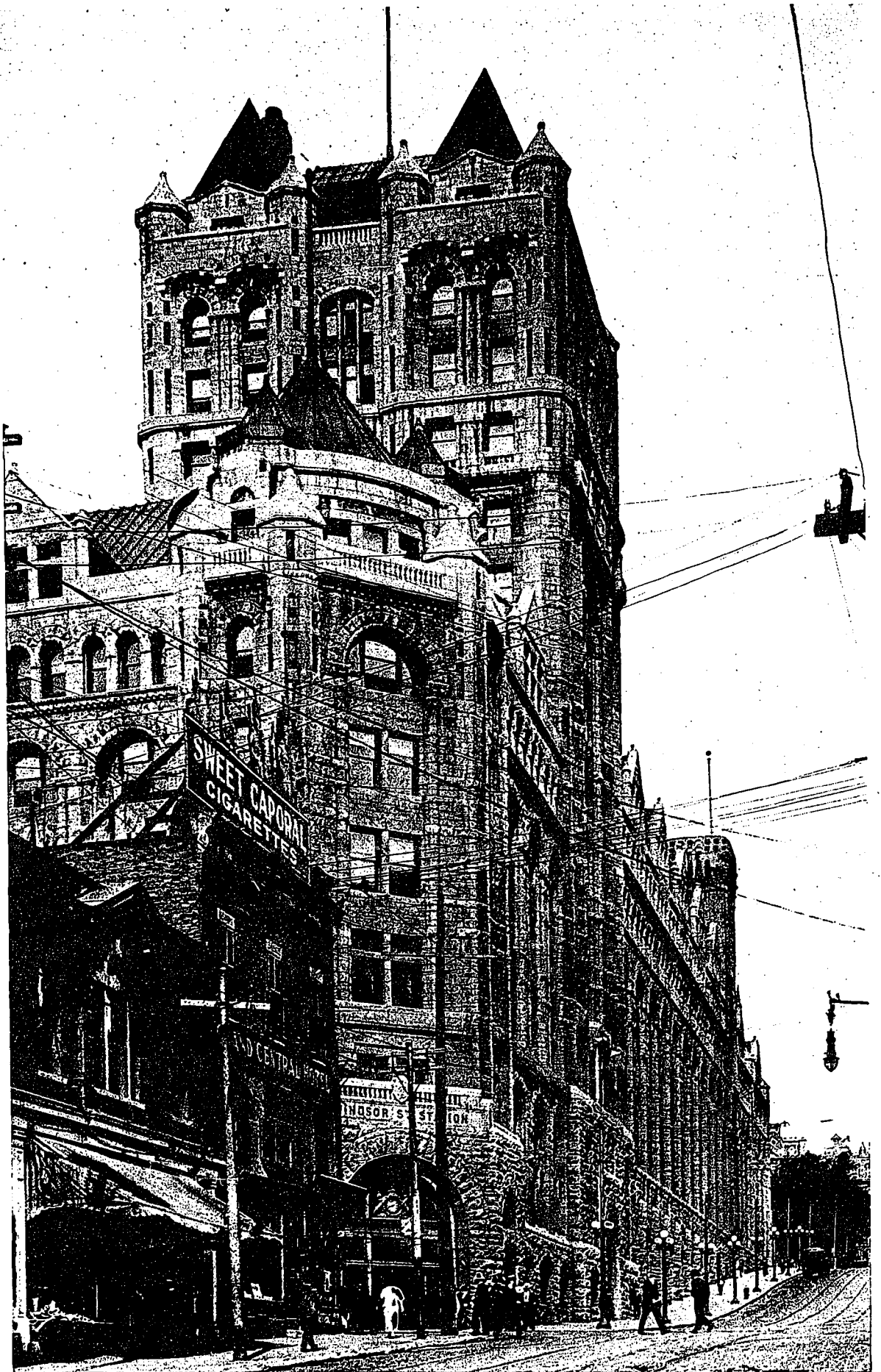
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THE WINDSOR STREET STATION, MONTREAL, QUEBEC.

W. S. PAINTER, ARCHITECT.

Panama Exposition and Fire Loss

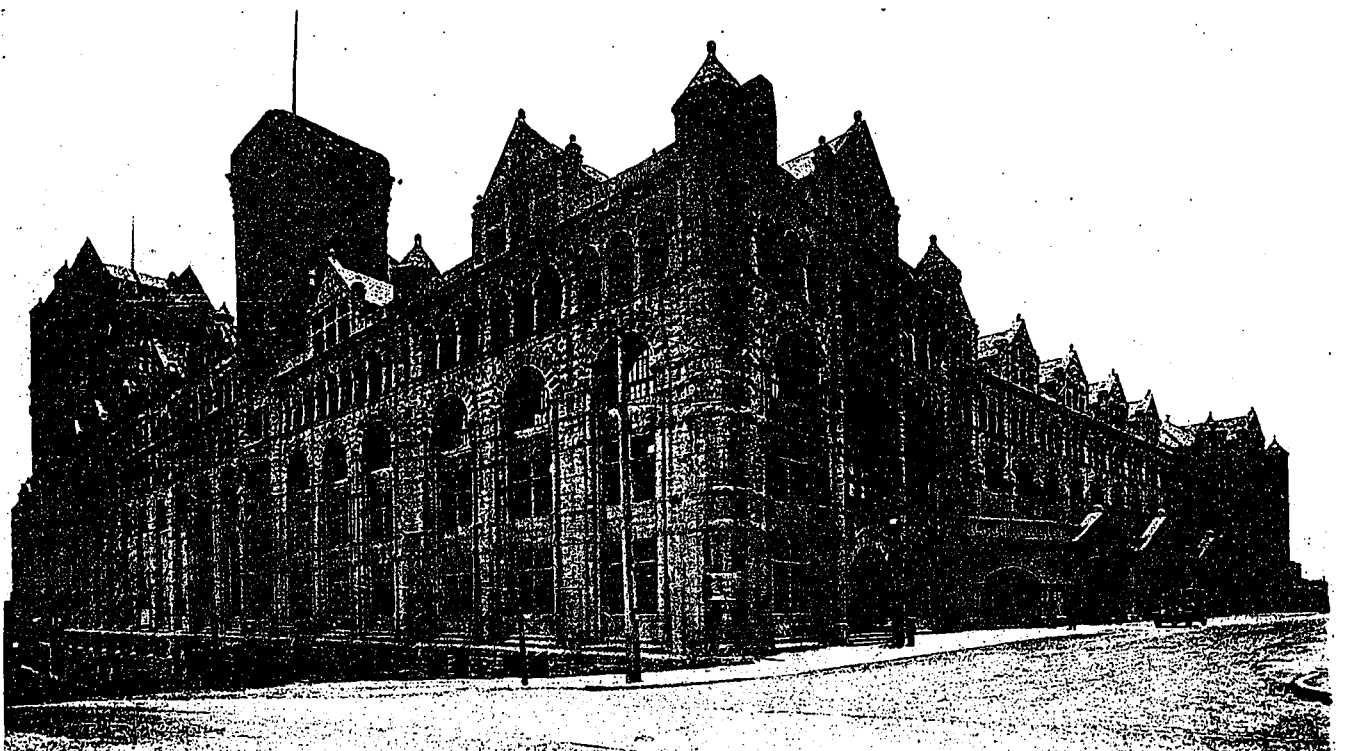
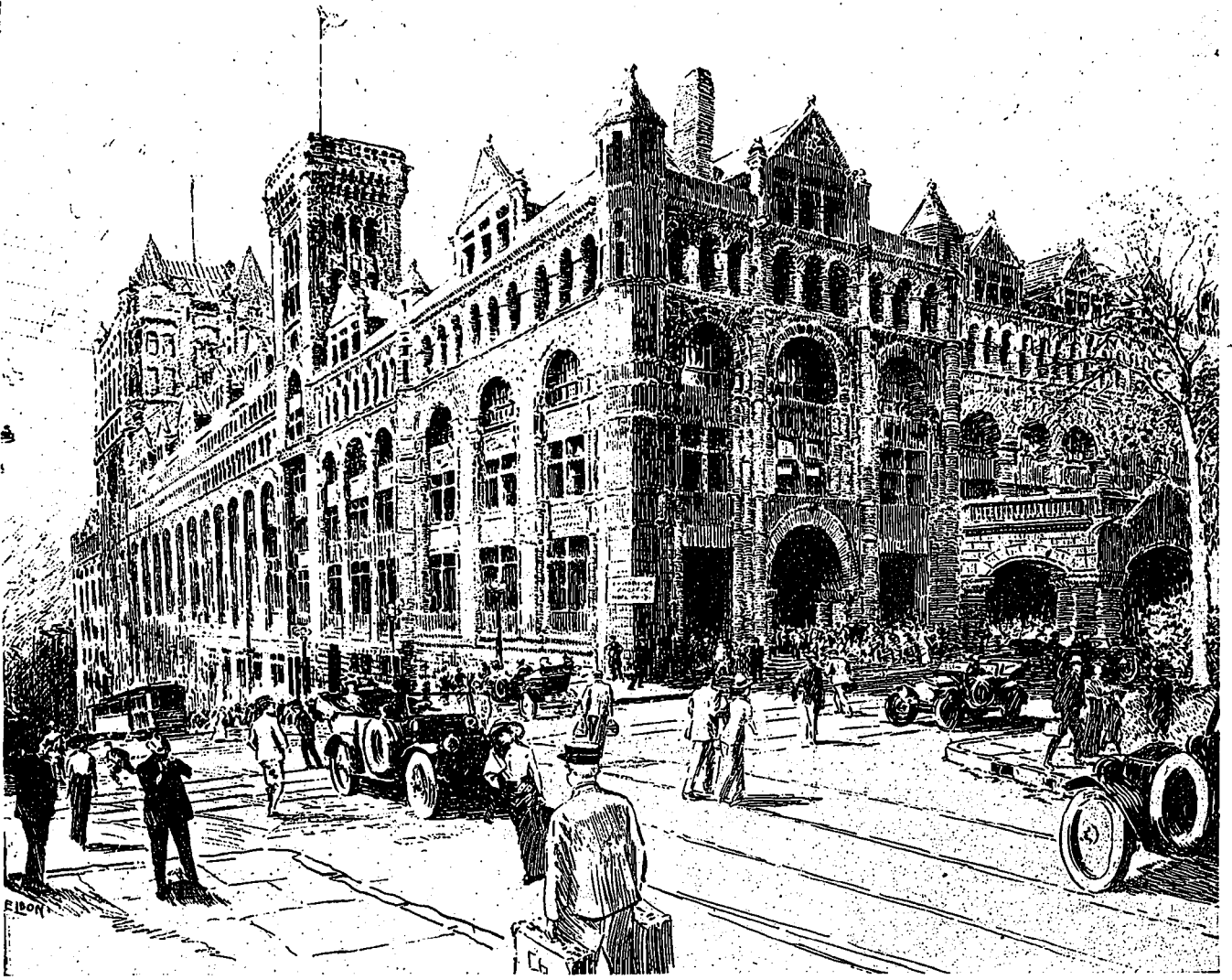
CREDIT TO WHOM CREDIT IS DUE

Deserving of unstinted praise are the builders in San Francisco. Within a space of three years six hundred and twenty-five acres of unimproved land has been transformed into a city of palaces with growing gardens, flowers, paved thoroughfares, fountains and all the various features which enter into the dreams of artists. Of this large space over sixty-four acres is devoted to the main Exhibition buildings, erected from the plans of our best architects, in a most practical and thorough manner. To prevent casualties due to weakness in construction or inflammable material the greatest of care was taken in the erection of each individual structure. Equal credit is due the engineers and designers. In preparing the site the problem was to remove the water from the submerged surface at Harbor view and replace it with soil. Over 200,000 yards of reclaimed area was finally covered with eight inches of dirt brought from all parts of California. To the architectural profession is due the charming atmosphere which permeates the entire display. Never in the history of world fairs has there been such a living, fascinating mosaic of color. The first view is enchanting, the last a memory, wherein the law of color harmony will live through its wonderful portrayal. And to pass unnoticed the landscape architects who furnished the harmonious setting for this city of color would mean a slight to those who have made the tout ensemble a marvelous work of art. Changing from the golden hue of pansies and daffodils to the scarlet tints of tulips and azaleas and then to begonias and so on until the Father of Time closes the gate, the millions who are privileged to enjoy this realization of Spanish castles, cannot help but feel that even the far famed glories of the Babylonian Hanging Gardens have been surpassed.

PREVENTION OF FIRE LOSS

The work of the National Fire Protection Association in educating the people to the irretrievable losses due to fires, is highly commendable. It is unquestionably due to their united effort that the recent damages effected by fire have been the lowest for many years. Their educational campaign more than warrants a continuance of the work and the broad ideas advocated during a recent session will reduce still more the enormous loss to Canada. These measures, if adhered to, will allow labor and capital to enter new fields of development instead of being used to restore the needless waste. The points enacted by the association

are given herewith: 1. The encouragement of fire-resistive building construction through the adoption of improved building codes by all states, cities and towns; the inclusion in such codes of adequate rules for exit facilities based on the occupancy for all buildings, and the general recognition of the fact that although fire-resistive construction is of the greatest possible importance, it is of itself not sufficient. The lesson of the greatest factory fire of the year is that large industrial buildings, even if built of cement and steel, must be subdivided by fire walls and must have adequate means of stopping fires in their incipency. 2. The adoption of laws or ordinances requiring the installation of automatic sprinkler systems as fire extinguishing agents in all factories, commercial establishments and city blocks. The adoption of ordinances requiring the construction of fire division walls not only as a property protection device but as providing the best life-saving exit facility. 3. The establishment by law of a Fire Marshal in every state, who shall not be a mere political office holder, but a trained man with trained assistants competent to direct the work as statistician, educator and prosecutor. 4. The investigation of the cause of all fires by public officials, and the enactment of laws fixing personal liability for damage resulting from fires due to carelessness or neglect. 5. The consolidation of all legal forces so as to provide for the systematic inspection of all buildings by local firemen, and technically trained building and factory inspectors so as to insure the vigorous enforcement of rules for cleanliness, good housekeeping, and the maintenance of safe and unobstructed exits, fire-fighting apparatus and other protective devices. 6. The especial safeguarding of schools, theatres, factories and all other places in which numbers of people congregate or are employed. 7. The vigorous state and municipal regulation of the transportation, storage and use of all inflammable liquids and explosives. 8. A careful study of municipal water supplies, their adequacy and reliability with special reference to their adequacy in case of conflagrations. 9. The universal adoption and use of the safety match. 10. The education of children and the public generally in careful habits regarding the use of fire. It is felt that Industrial Canada brings forth the right appeal when it states that Canadians could not do better than make this a fire prevention year and, by education and co-operation, try to forward the important task of reducing the appalling destruction which annually falls upon life and property in this country.



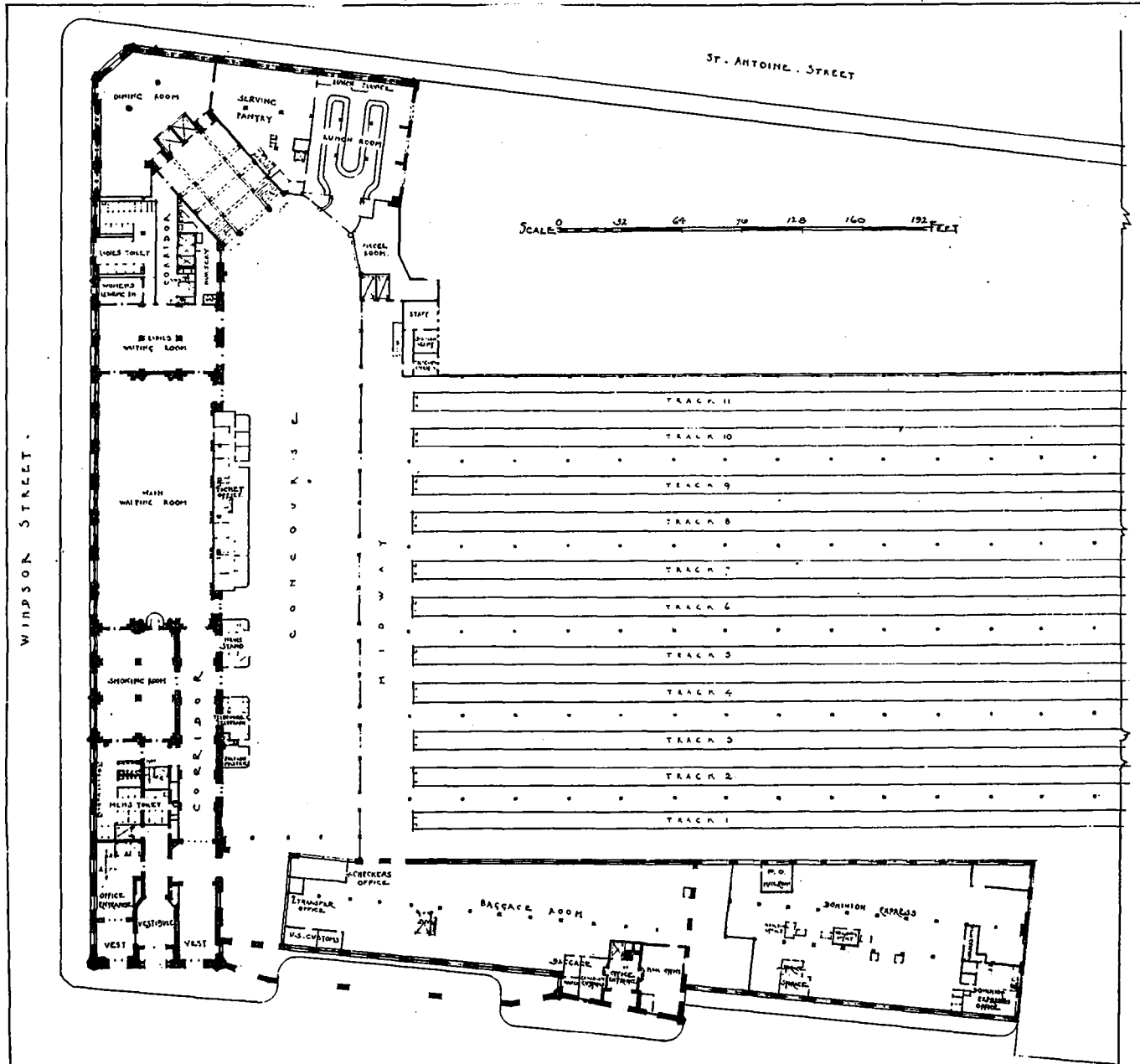
THE WINDSOR STREET STATION, MONTREAL, QUEBEC.

The Windsor Street Station, Montreal, Quebec

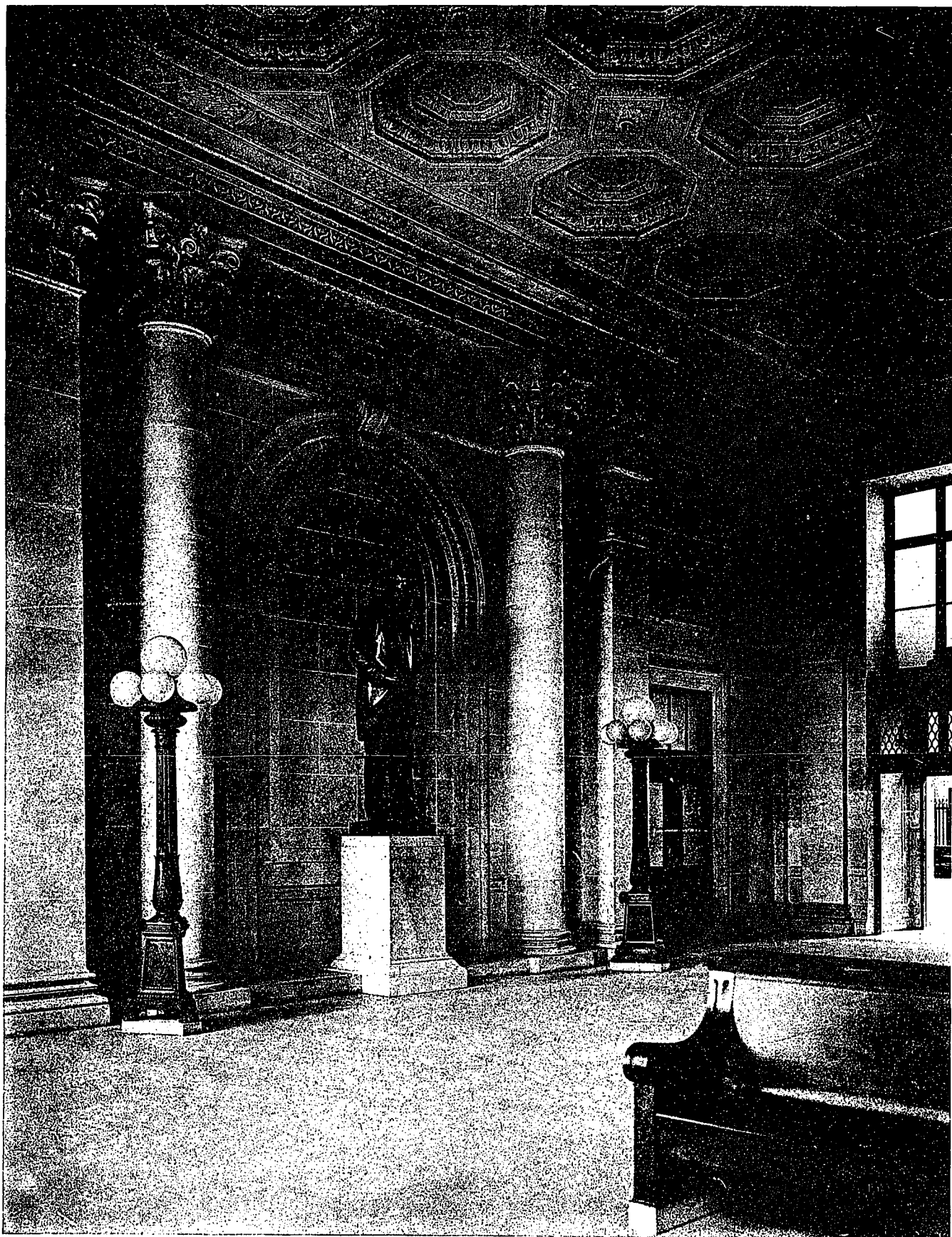
WHEN the doors of the Windsor Street Station of the Canadian Pacific Railway were thrown open to the general public it marked a great advancement in terminal structures. Three years of constructional work, following months of careful planning, evolved one of the largest stations in Canada, which not only caters to the vast throng of travellers, but houses as well the head offices of the company. Covering one complete block, with the three main facades facing Windsor, Osborne and St. Antoine streets, it forms a massive pile of grey stone, with its unusual height dominated by a huge tower.

Located on a hill, the large concourse is approached from one street on the level, and from

the other by means of immense elevators. Skylights extending the full length of the concourse furnish excellent natural lighting, which effect is also produced in the eleven track shed, over one thousand feet in length, ventilators being placed in the roof to expel all smoke. Running parallel to the concourse is the main waiting room, with the ticket offices between and the ladies' and men's waiting spaces at the ends. The general finish is of marble, with the design kept simple and effective, the lighting accomplished by lamp standards with incandescent tungsten lamps in clusters of six surrounding a large centre globe of white glass. At the end of the concourse, near the elevator approach from St. Antoine street, is located the



GROUND FLOOR PLAN.



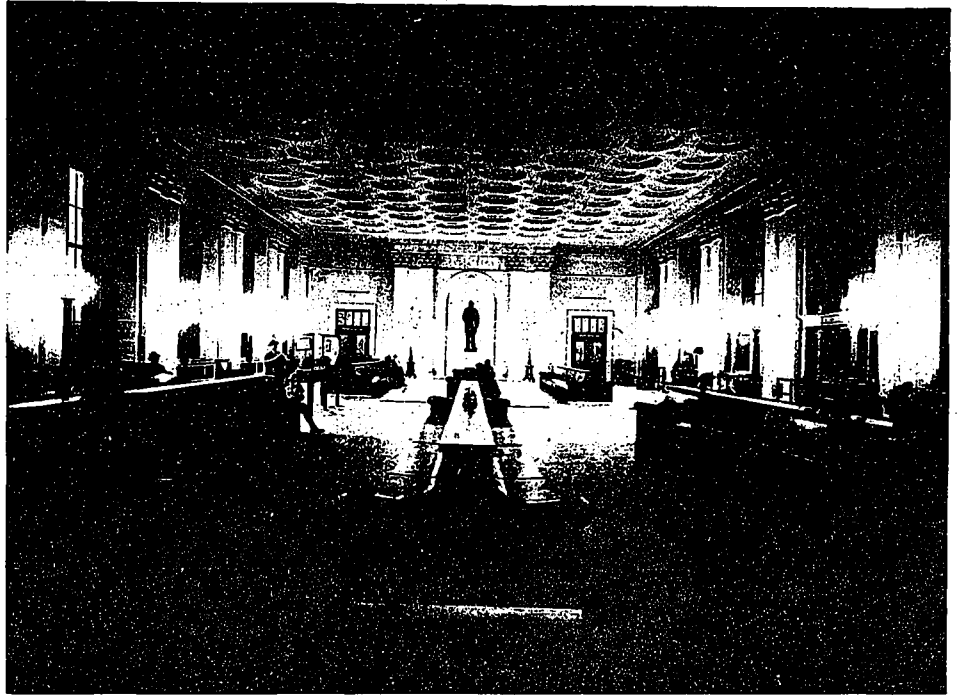
DETAIL OF MAIN WAITING-ROOM, THE WINDSOR STREET STATION, MONTREAL, QUEBEC, DESIGNED BY BAROTT, BLACKADER & WEBSTER, ARCHITECTS.

dining-room, restaurant and serving pantry, tastily decorated. At the opposite end of the concourse, and running along Osborne street, are the baggage and express rooms, with necessary offices, etc. Directly underneath the trainshed are accommodated the huge vaults and emigration quarters with natural lighting, on account of the slope towards St. Antoine street, where the entrances to this department have been arranged.

The first floor, aside from completing the lofty height of the concourse and waiting-rooms, is laid out for the car accountant's staff, as well as the quarters for the treasurer, paymaster, car service, baggage agent, manager and accountant of eastern division, and superintendent of terminals. On the second floor are housed the staffs for the president, general passenger and traffic, tourists, etc.; on the third floor auditors for agencies, disbursements, as well as freight traffic staff, press bureau and advertising department; on the fourth floor engineering rooms, and auditor of passenger receipts; on the fifth floor auditor of freight and telegraph. The tower plans, seven in all, are used respectively for the departments of photography, general fall, hotel, building construction, engineering clerical corps and tank room.

The following description of the mechanical equipment is authorized by the publicity department of the C.P.R.: In the boiler room is installed a battery of three four hundred horsepower water tube boilers, each equipped with superheaters and containing one hundred and forty-four four-inch tubes of four thousand square feet heating surface. The grate area is eighty-six square feet, and the boilers are operated under natural draught. The stack is of white brick, and two hundred and twenty feet high; the inside diameter at top being twelve feet, and the outside diameter sixteen feet. The three boilers are equipped with stokers of the chain grate type, while two simple five-inch by five-inch steam engines operate the grates. The engines are belt connected to an eccentric shaft, and a ratchet drive is the medium through which the eccentric rods are attached to the grates. The number of teeth per stroke is adjustable. Thus the attendant can soon adjust the speed of his grates so that the required head

of steam is maintained under ordinary conditions. The depth of the fire can also be regulated up to a depth of twelve inches. At present steam of one hundred and fifty pounds pressure, superheated one hundred and fifty degrees, is being obtained from a three-inch depth of fire. The boilers are equipped with an automatic damper regulator, the pressure of the steam acting on a piston indirectly, through a hydraulic application, and this acts on the engine through a throttling valve. This regulator



MAIN WAITING ROOM.

also controls the amount of damper opening, and keeps the steam pressure practically uniform.

Coal is brought to the power house in standard coal cars and is dumped into huge bins in the bottom of which are hopper-shaped openings. Out of these hoppers the coal is passed through the slide gates into the chutes. The slide gates measure out one-half ton of coal at each operation. The coal passes down the chutes and is delivered to the grates. Ashes are automatically dumped from the fire box into a concrete bin at the rear of the boilers. From this bin, they are raked out through passageways into dumping trucks running on a track at the rear. These trucks are run on to an elevator operated by the city water pressure, and are raised up to the ash receiving bins, where the truck is dumped. The dumping is accomplished by a special lever, being easily handled by one man. The ashes go into receiving bins from whence they are loaded through chutes into freight cars to be used for ballasting and filling in on the road construction.

There are two independent boiler feed units of the vertical single cylinder steam driven



ENTRANCE LOBBY.

type, each being capable of supplying the full boiler capacity. The suction is taken from the feed water heater. Each pump is capable of delivering five thousand one hundred Imperial gallons per hour when making twelve double strokes per minute, against a boiler pressure of two hundred pounds, the feed water temperature being about two hundred and ten degrees Fahrenheit. The bore of the steam cylinders is ten and one-half inches, and that of the pumps eight inches, the stroke of both being twenty-one inches.

A carbon dioxide recorder is fitted to the stack, and adjustments are made to the dampers, grate speed, etc., enabling soft coal to be burned with almost a total absence of smoke. The safety valves are set to blow a little in advance of one hundred and fifty pounds, and the whole system is controlled automatically, while the attendants and engineers have at all times available complete information concerning each and every part of the apparatus. The feed

water heater is also in the boiler room, but as it is so closely connected with the heating system it was thought advisable to describe it under that head.

The boiler room is situated at some little distance from the engine room; steam is therefore conveyed to the engines through a tunnel, some seven feet square, for a distance of seven hundred feet. There are four pipes through the tunnel; one of eight inches diameter heavily insulated carrying the superheated steam. A similar pipe runs immediately below it carrying saturated steam to be used in the event of a breakdown in the superheating system. A heavily insulated ten-inch pipe carries the exhaust steam back to the feed water heater, and a well insulated four-inch pipe carries the hot water of condensation back to the feed water heater. The idea of superheating the steam was to be able to carry it through the tunnel and deliver it to the engines dry and without reduction in pressure.

There are thirteen elevators in the building which operate from hydraulic pressure supplied from the pumps in the engine room. This includes three sets of duplex pumps, two of which are of five hundred U.S. gallons per minute capacity. They are each double acting, outside packed, and are driven by two sets of tandem compound steam cylinders, of fourteen inches high pressure and twenty inches low pressure diameters. The diameter of the pump cylinders is nine and one-half inches, and the stroke is fifteen inches. The third pump is larger, having a capacity of one thousand U.S. gallons per minute. Its steam cylinders are eighteen inches and twenty-nine inches in diameter for the high and low pressure cylinders respectively, while the pump cylinders are twelve inches diameter and the stroke eighteen inches.

The pumps supply water at one hundred and fifty pounds pressure per square inch to the tanks for operating the elevators, and are equipped with a hydraulic governor. The water tanks are all air-cushioned to prevent injury

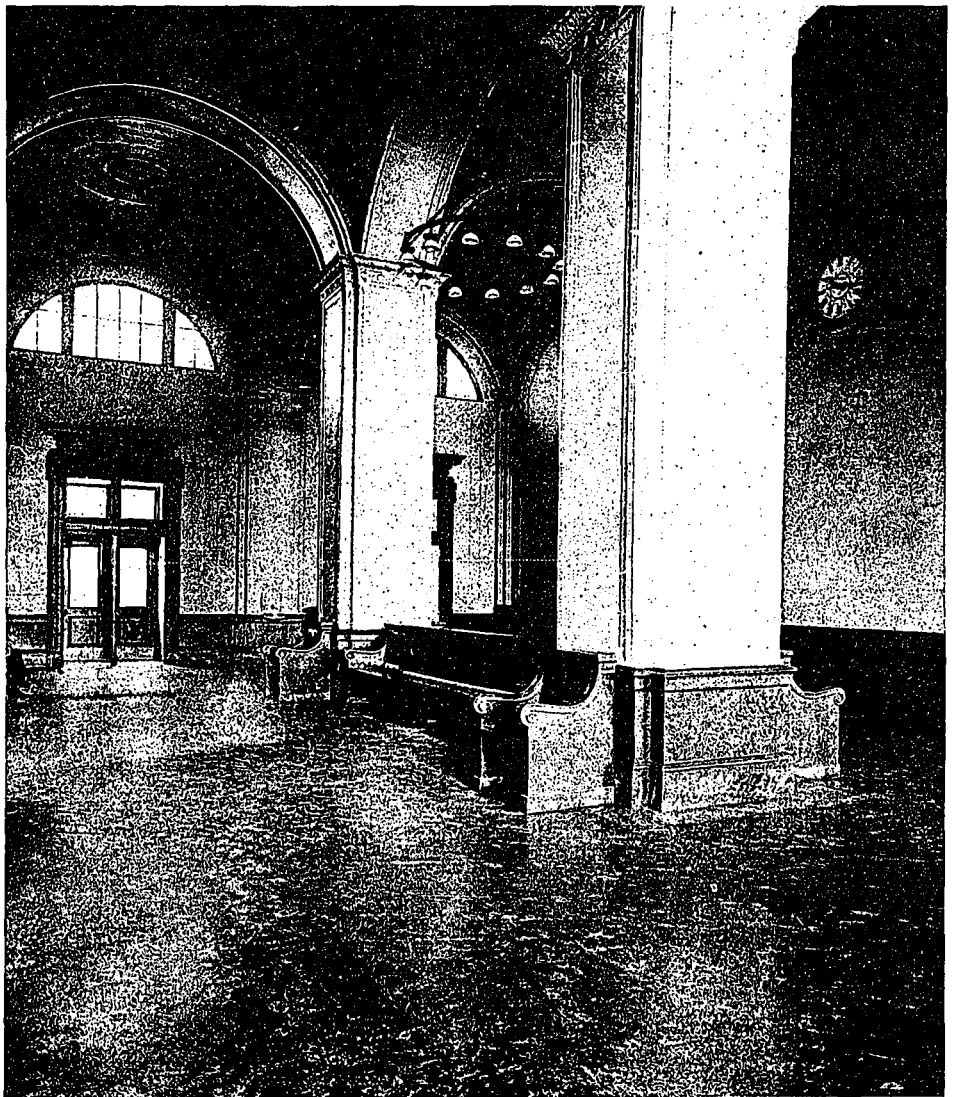
from water hammer and to assist in governing the pumps. The air cushion prevents the pumps from ever having to run at an excessively high speed to supply water in the case of a sudden drain on the tanks. The air for the air cushions is supplied by two two-stage, steam-driven air compressors, with eight-inch bore steam cylinders and air cylinders of six-inch and three-inch bore. Both compressors are alike, and have a stroke of eight inches. They supply air at one hundred and fifty pounds pressure per square inch, and usually receive air from the tank into which the large compressor discharges. This air is compressed to eighty pounds per square inch, and the little compressors step it up to one hundred and fifty pounds. They can also be operated independently of the large compressor and then use atmospheric air. The deepest elevator shaft is about two hundred and fifty feet below the surface of the ground.

The large service pump is a single cylinder vertical and steam-driven unit, similar in design to the boiler feed pumps. The steam cylinder is over the pump cylinder, and its valve is actuated from a link attached to the piston rod. The steam cylinder is of sixteen-inch bore, the pump cylinder of ten-inch bore, and the common stroke is twenty-one inches. This pump is capable of delivering twenty-four thousand three hundred Imperial gallons per hour against a head of one hundred and seventy feet when supplied with steam at one hundred pounds pressure, and back pressure of three pounds. It is capable of maintaining a pressure of fifty pounds per square inch at the fire hydrants when three standard seven-eighth-inch nozzles are being used. It is a reserve unit for emergency calls.

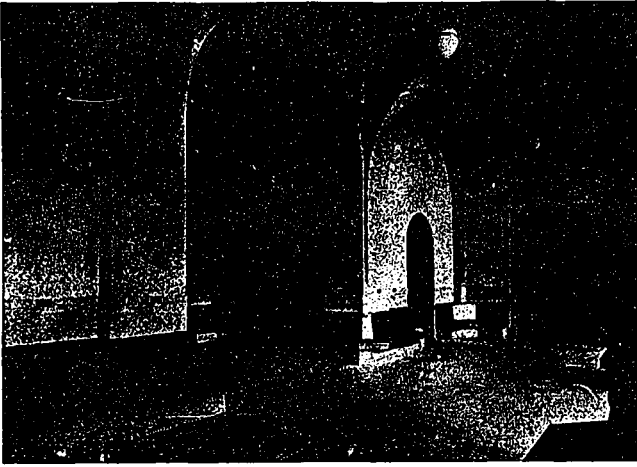
The use of compressed air throughout the terminal is rather extensive. The main uses are, however, for charging train lines, testing air brakes and blowing out boiler tubes. There are, of course, many other minor uses, but the greatest quantity of air is consumed through the three above mentioned channels.

The main compressor is a single stage machine, with a simple steam cylinder, fitted with a tail rod. The steam cylinder is fourteen-inch bore, and the air cylinder twelve-inch bore, the common stroke being eighteen inches. The machine compresses to eighty pounds per square inch. The air cylinder waterjacket receives its supply from the city mains, and although the machine is not of the latest design, yet owing to a previous excellent record it has been still retained for service in the terminal. The two smaller compressors are two-stage machines used in connection with the air cushioning in the elevator water tanks.

The refrigeration system caters to a very extensive and important department. There are three ammonia compressors, all of them steam driven. Of these, two twenty-ton units of horizontal design expand the ammonia in a common tank, the brine being used for ice-making. Brine circulation is by means of two five-inch by five-inch duplex pumps. The third and smaller unit is of five-ton capacity and of the vertical marine type. The ammonia is ex-



LADIES' WAITING ROOM.



SMOKING ROOM.

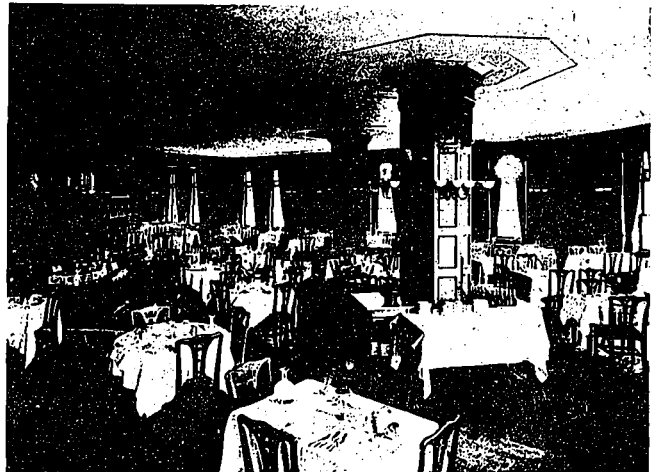
panded in an independent brine tank and this brine is used to cool the drinking water, freeze ice cream and cool the cold storage rooms. The circulating pump is a four-inch by four-inch duplex pump. The steam supplied to these engines passes through a reducing valve and is delivered to them at one hundred pounds pressure. With the assistance of the governors this tends to make the operation of the systems quite uniform. The delivery temperature can be easily brought down to fourteen degrees Fahrenheit or lower on the very warmest days. There is also installed a brine delivery temperature recorder.

The artificial can ice-making plant is capable of freezing twenty-five tons of ice per day, the latter being used in the dining and lunch rooms and on the dining cars. The brine is used to cool the drinking water. The water first passes through filters, and is then cooled to forty degrees. After it leaves the brine tanks, it is pumped to the various tanks by a three-cylinder single-acting four-inch by six-inch pump, which is gear-connected to a five horse-power volt motor. A second similar pump is mounted near this pump, but up to the present the demands have not been beyond the capacity of the one pump. The capacity of one pump is one thou-

sand Imperial gallons every twenty-four hours.

The vast quantity of piping in the boiler and engine rooms would render it often very difficult to locate or trace particular lines. Thus, a color scheme has been introduced, and this is followed to a great extent throughout the whole building. A yellow pipe carries live steam; a black pipe, exhaust steam; a blue pipe, hot water; and a red pipe, cold water. The heavy cork insulation on the brine piping is also painted black, as for the exhaust piping, but on account of the lay-out no confusion is caused. For hot water heating in wash rooms, low pressure or exhaust steam is passed through coils in two tanks in the engine room, but for heating water used in the wash rooms above the fifth floor a third smaller tank is employed, through the coils of which live steam is passed.

There are three large tanks in the top of the building which supply water to the lavatories. If these tanks are ever filled too full, and are liable to overflow, a red incandescent lamp in

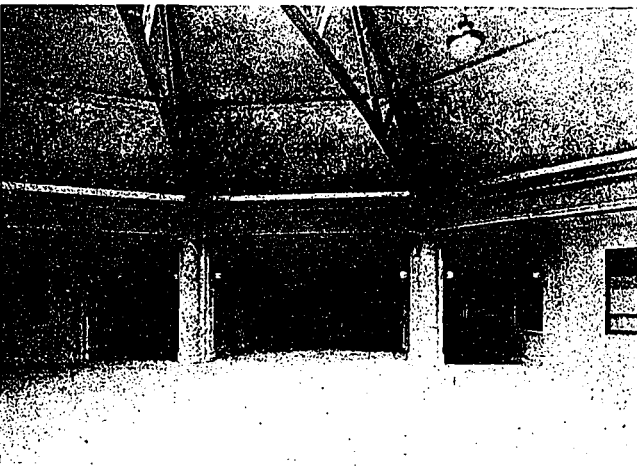


DINING ROOM.

the engine room warns the engineer of the fact. Should, however, the water supply be normal, a white light is kept burning to acquaint him of the fact. A constant record of the pressures of the live and exhaust steam is kept by continuous recording instruments.

The whole heating system is on the vacuum principle. The steam employed is the exhaust of the various engines, and on cold days this is supplemented by boiler steam passed through a reducing valve. The steam passes into the main exhaust header, from which all steam heating lines lead. At night, when but few of the engines are running, the heating system depends largely on the boilers for the source of supply.

There are three pumps which extract the water of condensation from the returning steam and pump it through the four-inch pipe in the tunnel to the one thousand five hundred horse-power feed water heater. The pumps are all of the same size, namely, eight-inch by ten-inch,



END OF CONCOURSE.

with a stroke of twelve inches, which create a vacuum of about ten inches. The exhaust steam passes back through the tunnel and enters the feed water heater. The temperature of the water as it enters the boiler is about two hundred and ten degrees Fahrenheit. A temperature recorder regulates the temperature of the feed water. Aside from the ordinary steam-heating system there are installed several steam lines to the roofs of the buildings and train sheds, to melt the snow when a sufficient quantity accumulates.

The problem of ventilation was a difficult one, and the very efficient system installed certainly reflects great credit upon the designers. Several large fans are employed of the multivane type and arranged so that the air is thoroughly screened as it is taken from the atmosphere. The ventilating system can really be divided into three small systems. In each of these, the air is heated before being washed, and again reheated after washing to seventy degrees



BARBER SHOP.

being fifty-two and one-half inches in diameter by twenty-eight and one-eighth inches wide, and is capable of delivering thirty-one thousand three hundred cubic feet of air per minute against a pressure of one inch of water. It is direct connected to a seven-inch by ten-inch engine, which runs at a speed of two hundred r.p.m.

The third system supplies air to the vaults and emigrant rooms, and also the Chinese detention rooms. This air washer receives its supply of water from a centrifugal pump direct connected to a five horse-power motor. The fan is seventy-two and seven-eighths inches in diameter by thirty and one-half inches wide; capable of delivering forty-two thousand cubic feet of air per minute against a water gauge pressure of one inch, and direct connected to a ten-inch by ten-inch engine running at one hundred and sixty r.p.m. In the Chinese and emigrant quarters, three exhaust fans are located on the ceiling. Two of them are No. 80, steel plate, blower fans, belt connected to five horse-power motors, while the third is a twenty-four-inch propeller fan, belt connected to a two horse-power motor.

The main exhaust fan is located in the engine room, near the ventilating fans, fifty-eight and



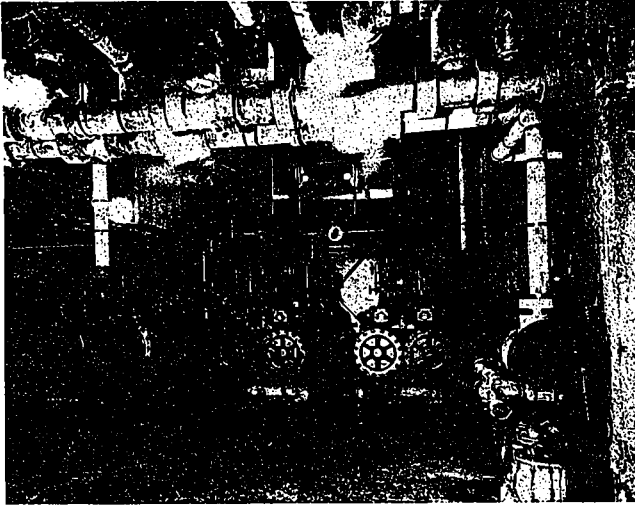
LUNCH COUNTER.

Fahrenheit. The air, in the largest of these three systems, passes from the atmosphere to the heating steam radiators and on to the washing chamber, where it passes through sprays of water. The water is pumped by two centrifugal pumps, each direct connected to five horse-power motors. From the water sprays it passes through the second steam radiator set and then on into the fan, which is ninety-three and one-quarter inches in diameter by forty-nine and three-sixteenths inches wide, and delivers one hundred and two thousand cubic feet of air per minute against a pressure of one and one-quarter inches of water. It is direct connected to a ten-inch by twelve-inch engine, which runs at one hundred and sixty r.p.m. This system delivers air to the main floor offices, waiting-rooms, dining-room and restaurant.

The second system ventilates the offices and corridors on the upper floors. The air washer receives water from a centrifugal pump direct connected to a five horse-power motor, the fan



NURSERY



DUPLEX PUMPS FOR ELEVATORS.

one-quarter inches in diameter by thirty and fifteen-sixteenths inches wide, and is capable of delivering thirty-one thousand five hundred cubic feet of air per minute against a one inch water gauge pressure. It is direct connected to a six-inch by six-inch engine running at two hundred and seventy r.p.m. The air in cold weather is delivered at seventy degrees Fahrenheit. The specifications call for the following changes of air and the system has fulfilled the requirements to the satisfaction of the company: Toilet rooms every six minutes; exterior toilets every eight minutes; offices every twelve minutes; waiting rooms every twenty-five minutes; smoking rooms every twenty minutes; dining and lunch rooms every fifteen minutes; kitchen every twelve minutes.

The applications of electricity are many and varied, and numbers of devices involving them are being installed at the present time. Throughout the building, clocks are distributed which are controlled electrically by one master clock. This ensures all clocks being always absolutely correct. One man is enabled by an electrical announcer to inform people in all parts of the station as to the arrivals and departures of trains, and such other information as may be necessary. The announcer merely speaks into a transmitter and his voice is reproduced in various places over the building. This announcing apparatus is placed in all parts of the concourse, waiting-rooms, dining-room and restaurant.

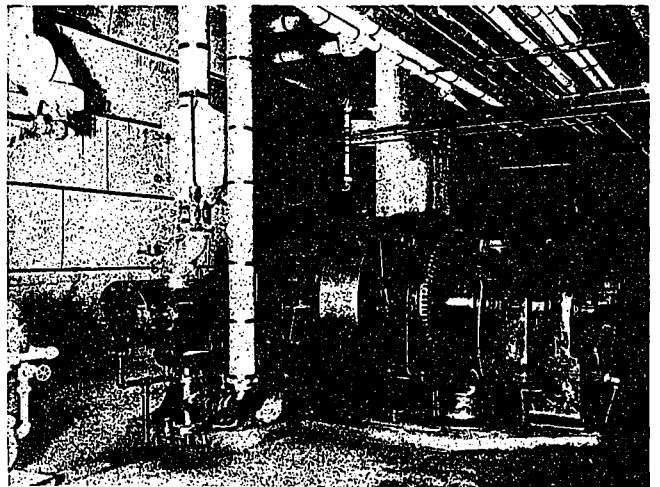
The switching and signal tower at the entrance to the yards is able to control the yard entirely by electrical devices. The switches are opened or closed and all the signals manipulated by the proper switches being operated in the little tower. A model plan of the yard is located in the tower, and on this plan a bright electric glow shows the particular section of the track on which a train is standing. Thus the switch man has at all times an accurate and complete knowledge of the progress of all trains in the yard. Every switch that is thrown, every signal

moved, sends back to the tower an automatic confirmation of the event after it has transpired. The system is automatically interlocking, and thus guards against the possibility of a collision. Should the source of supply of electricity fail, the tower is not useless. In the basement there is a battery of storage cells which are quite capable of supplying sufficient electricity to run the equipment for two days at least.

To facilitate the handling of baggage several large baggage trucks are equipped with storage batteries and motors. These trucks can receive baggage from a train and quickly have it in the baggage room for delivery. In this way two men can handle a large quantity of baggage very rapidly. These trucks are charged each night.



In an article on recent railway stations, in the "Architectural Record," H. D. Eberlain states that station building, indeed, is our newest form of architectural activity, if we except hangars and landing stations for aeroplanes and dirigibles, or modified show houses for "movies." It is a form of structural expression that was left for the nineteenth century to originate, and for the twentieth century to bring many stages



ELECTRICAL EQUIPMENT.

on the road to perfection. All other edifice types have centuries of architectural precedent back of them—theatres, libraries, churches, collegiate groups, banks and even hotels; whose most modern developments have been both indirectly and directly due to the influence of railroads.

This dependence on the workings of evolution and timely adaptation of traditions is sane and natural, just as much in architecture as elsewhere. All our best work in any field of human enterprise must necessarily have a foundation on which to build, a fruitful soil of tradition from which it springs. Originality cannot be made to order. The man who deliberately sets out to be original, who wilfully casts aside tradi-

tion and ignores the experience of his predecessors and contemporaries, who says, "I am going to do something quite new and unlike anything that has ever been done before," generally succeeds in doing something quite asinine and hideous. Abundant examples of distressing gaucheries, inspired by this insensate mania to do something merely different, are not wanting in the world of art and elsewhere. Originality, that is, sane originality, is a growth and must come through the reasonable combining, adapting and modifying of well-known forms, as commonsense and the obvious exigencies of the occasion demand; and that is precisely the way it has come in the instances now claiming our attention.

From the very nature of the problem, a large element of pure engineering is necessarily involved in station planning and hitherto much actual progress has been achieved, both in respect of engineering and architectural excellence, for which due praise is to be meted out severally to architect and engineer. Within recent years this advance has been conspicuously marked. With the completion of each newest station of importance, the public is apt to feel that the goal has been reached, the perfect ideal realized; and then, within a few months, perhaps, or years, comes some radical change, due to electrification of motive power, subway arrangements or what not, and we find the erstwhile paragon full of imperfections and unsuited to altered conditions. At any rate, no absolutely fixed, distinctive type has yet been evolved, and theories, while not altogether in a state of flux, are, nevertheless, not fully established.

Certain principles of station design, however, have been gradually gaining clearer definition and more general acceptance, and render it possible to establish special canons of criticism applicable to station architecture. Because of the large proportion of purely engineering work involved in their plan, it becomes necessary to regard railway stations, more than almost any other class of buildings, in their dual capacity, as, in the first place, satisfactory solutions of wholly practical requirements, and, in the second place, fitting embodiments of artistic conceptions.

The solely practical requirements for a modern city railway station may be broadly classified under the two comprehensive heads of (1) cost and (2) efficiency. In considering the former it is well to make two divisions, the initial cost and the cost of upkeep. Under initial cost will be included the outlay for real estate and all expenses contingent upon the purchase of materials, the erection of the fabric and the installation of all equipment. Under the head of upkeep are to be counted the charges for

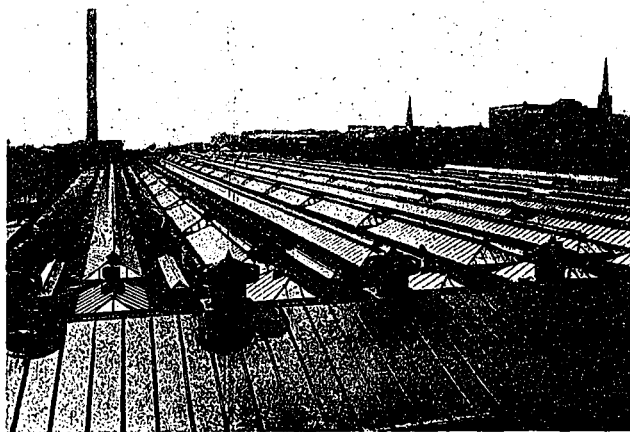
heat, light, cleaning, service and various sundries. Railroad treasuries are not inexhaustible mines of wealth, and the cost of buildings and their maintenance has to be counted beforehand, just as carefully, and planned with as much regard for economy as in the case of private in-



REFRIGERATION PLANT.

dividuals or small corporations. Inasmuch as the maintenance of a railway station is accounted a part of the company's fixed administration charges, and the first cost should represent not an unbusinesslike and capricious bit of extravagance but a part of the railroad's permanent capital investment, from which the stockholders are justified in expecting a reasonable return, the principle of close economy—this does not, however, mean narrow-minded, pinchbeck parsimony—and avoidance of unnecessary expense should be observed as one of the first essentials in making preliminary designs.

A second important principle, the principle of direct communication and facility of circulation, is to be deduced upon the score of efficiency. The intelligent observance of this principle will preclude congestion in handling passenger traffic, the congestion that too often occurs in



SKYLIGHTS OVER TRAIN SHED.

passage to and from trains or through the mingling of waiting passengers with those passing quickly in or out.

A third principle, also ranged under the head of efficiency, stresses convenient arrangement and economy of space. Conscientiously following its lead, the architect will endeavor to place all the facilities for the accommodation of patrons as close together, and as near the central part of the station, as possible, so that they may be readily accessible. He will also endeavor to make the distances to be traversed by the incoming or outgoing passenger, between trains and exits or entrances, as short as may be. Plumbing, ventilation, light and a hundred other details, while they are to be largely considered under the distinctly practical side of the work, have no especial bearing upon the essential requirements of plan.

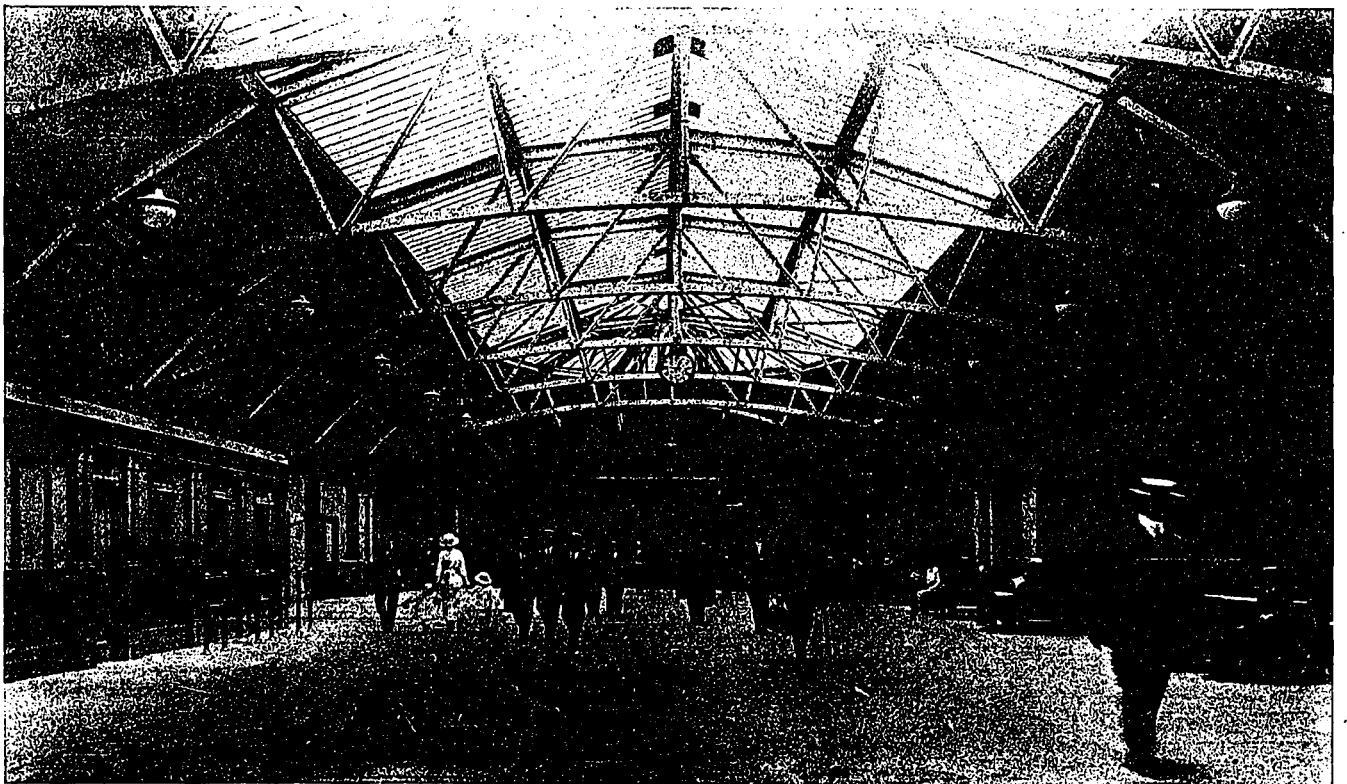
We pass now to the purely architectural requirements of urban railway stations and the noting of another set of principles concerned therewith. If any reader is disposed to cavil at placing architectural considerations second in order, let him remember that this order is strictly logical, that the plan with all its efficiency and engineering problems must be satisfactorily developed first before the skeleton can be clothed with a form of grace, and that a departure from this method of procedure almost invariably spells failure. Such failure, too, is more noticeable in a station than in any other building, because of the constant emphasis placed upon practical requirements by the conditions of daily usage. It would not be a hard

matter to point to cases where the logical method of working seems to have been forgotten at times and with the result that might naturally be expected. If the axiom that the exterior of a building should express its purpose is conscientiously observed, it is obvious that the desired correspondence can be achieved only by working outward from the interior plan which may be regarded as the visible embodiment of the purpose. Any other method is architecturally dishonest.

From an examination of the trend of station architecture in past years one may trace the growth of at least three well defined principles. The first of these is architectural responsibility on the part of the railroad to the public. This recognition of responsibility on the part of railroad management is to be interpreted not merely as a concession to public taste, but as a desire to bestow worthy treatment, suitable to the dignity of the community, upon a building that is in effect the gateway to the city.

Next comes the principle of just expression of architectural purpose in form of structure, involving the adaptation of a style to manifest needs, the achievement of a somewhat monumental effect in accord with the building's importance, and, finally, the elimination of all inappropriate or meaningless detail.

Last of all is the principle of congruity with surroundings which demands that a railway station, which affords a large latitude in the choice of architectural type, should be in keeping with the other representative buildings of the community in which it stands.



CONCOURSE.

Bank of British North America, Montreal, Quebec

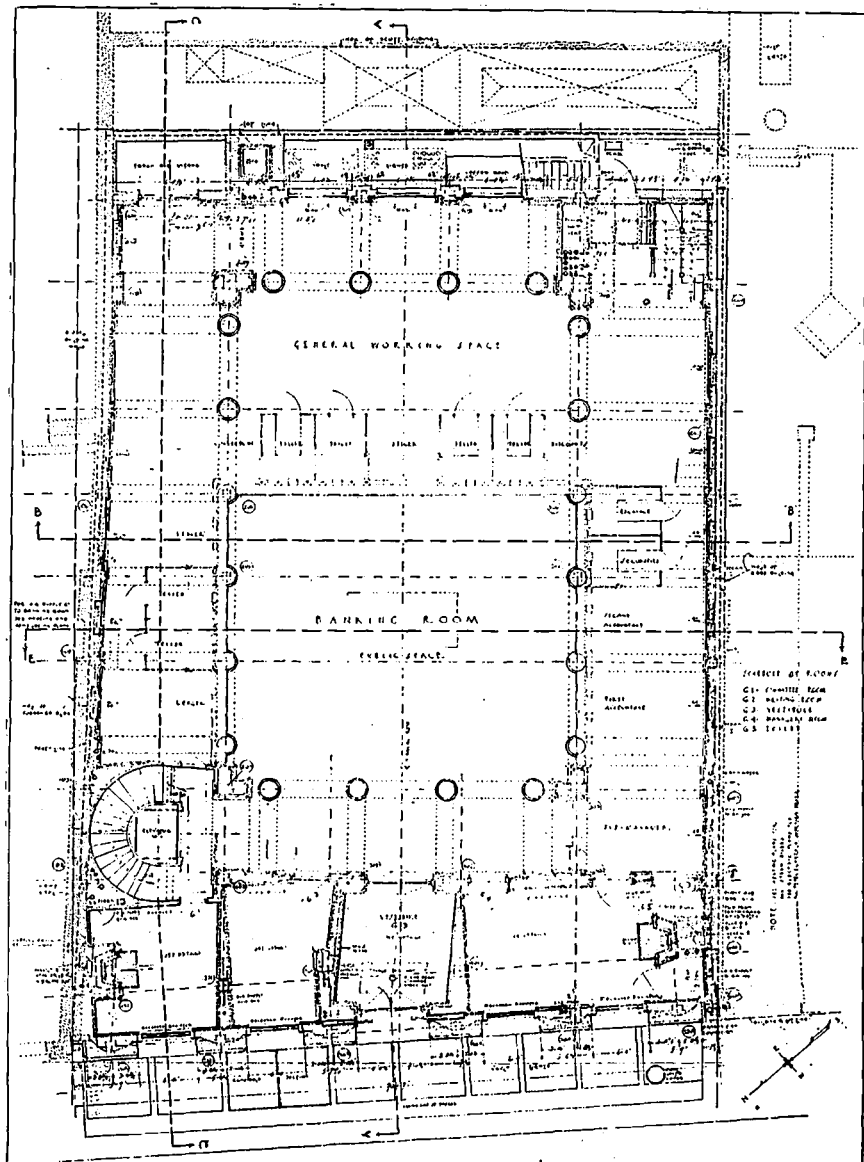
A BANK to possess the necessary facilities for proper administration must be a resultant of the combined efforts of banker and architect. This is often a serious difficulty, as the banker lacks the faculty, as a rule, of interpreting plans, while the architect can rarely spare sufficient time to inform himself of the various needs and proper methods for executing same. Sometimes the trouble is evaded by calling in the services of a specialist, who becomes the official medium between the client and the designer, thereby facilitating the work of both.

In the Bank of British North America, located on St. James street, the firm of Barott, Blackader & Webster have successfully solved the problem, adapting the design and arrangement to meet the present needs and still adhere to the architectural style of the original structure. They have secured the greatest amount of efficiency in the available space and brought the administrative corps in close relation to the general public.

Upon entering one passes through heavy walnut doors elaborately carved into the vaulted vestibule lined with marble, which in turn opens into the banking room proper, seventy-four feet long, sixty-five wide and thirty-five high. Twenty fluted columns, eighteen feet in height, support the clere storey, while above is a deeply coppered ceiling, richly ornamented and painted in varying harmonious shades, with the ornament picked out in gold leaf and color. The screen and counter is one hundred and five feet in length, the latter supporting a low polished bronze and glass screen, except where enclosures are required for the tellers' cages, at which place the screen is of a greater height and formed of bronze pilasters and cornice, with bronze mesh enclosures at the rear and sides. The trim and fixtures throughout are of mahogany, and the floor in the clerical section of compressed cork, and that in the public space of marble.

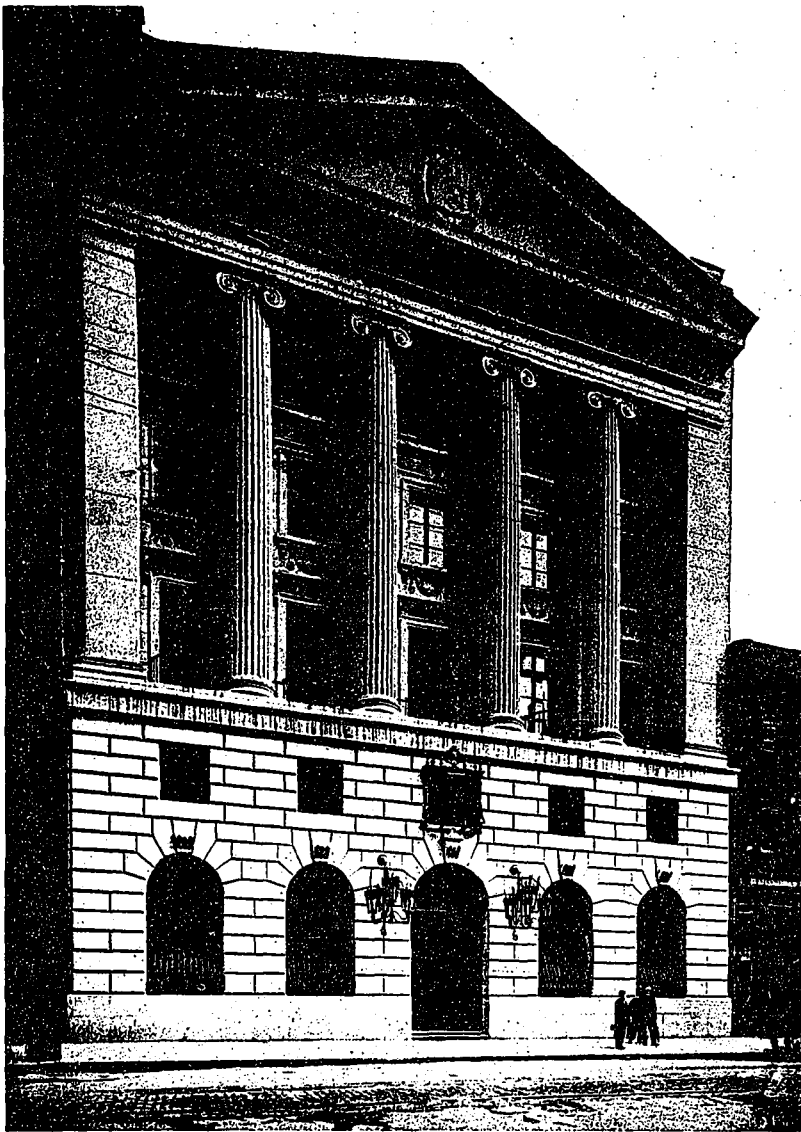
In order to obtain the maximum amount of direct light for the banking room, the side walls

of the building were recessed to form courts above the main ceiling and skylights installed over the side clerical sections, the clere storey being pierced with openings into the same side courts, while in addition to these large windows are located in the rear wall of the room. Facing the principal street and directly off the banking room are located the local manager's office, and rooms for correspondence and committees. The general manager's and executive offices are over the banking space, the former being twenty-six by twenty feet, designed in mahogany, and amply lighted by three large casement windows. On the second floor is located additional clerical and staff offices, while on the present top floor ample accommodation is provided for the use of the staff, consisting of living and bedrooms, dining-room and kitchen in addition to a large filing room.



MAIN BANKING ROOM FLOOR PLAN.

The main facade and returns are faced with granite, the lower portion of the building forming a heavily rusticated base supporting the free standing Ionic colonnade, thirty-five feet in height, surmounted by a pediment, in the tympanum of which is carved a shield with the bank's coat-of-arms thereon and enclosed by a wreath. The side and rear of the building are faced with sand-lime brick, with the exception of the recessed courts, where enamelled brick



THE MAIN FACADE.

has been used. All windows in the courts and at the rear are of hollow metal, glazed with wire glass. The building is of a steel skeleton construction, there being about six hundred and fifty tons of steel utilized. In order to eliminate columns throughout the large office sections and in the banking room, clere girder spans were adopted, which make the building practically supported by four pylons at the corners, and designed so as to accommodate future additional storeys when needed. The floor construction throughout is of reinforced concrete; the partitions and furring of terra cotta. The building

is equipped with the most modern ventilating, heating and plumbing systems, with auxiliary boilers for breakdown service.

The main security vault is located in the rear of the basement, constructed of three-inch laminated steel plates, enclosed with heavy reinforced concrete walls and floor construction, and equipped with heavy double doors and electrical protection. The vault is isolated from the main walls of the building, allowing inspection space around all sides. Immediately below the security vault in the sub-basement is a large fireproof book vault. The general treatment throughout the building is of quartered oak, with the exception of the special offices and main rooms, where mahogany is used; the floors of the clerical section are of rock maple, and in the special rooms are of herringbone quartered oak. Elevator enclosures are of bronze on the main floor, and ornamental iron throughout the balance of the building, while the main and rear staircases extending from the basement to the roof are of marble with wrought ornamental iron rails.

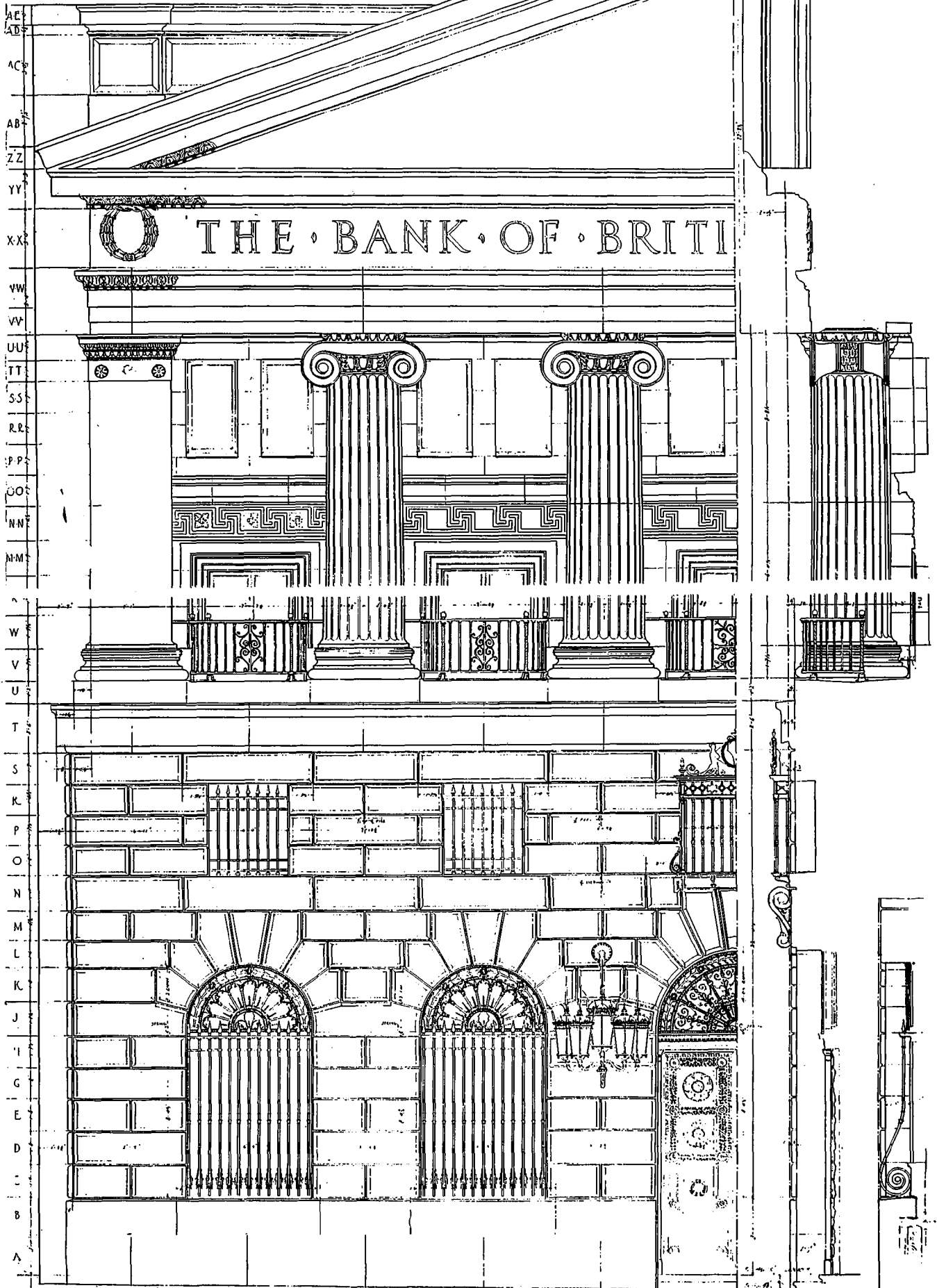
The following article on heating and ventilation of banking rooms was prepared by Charles L. Hubbard, an authority of considerable experience in matters of this nature:

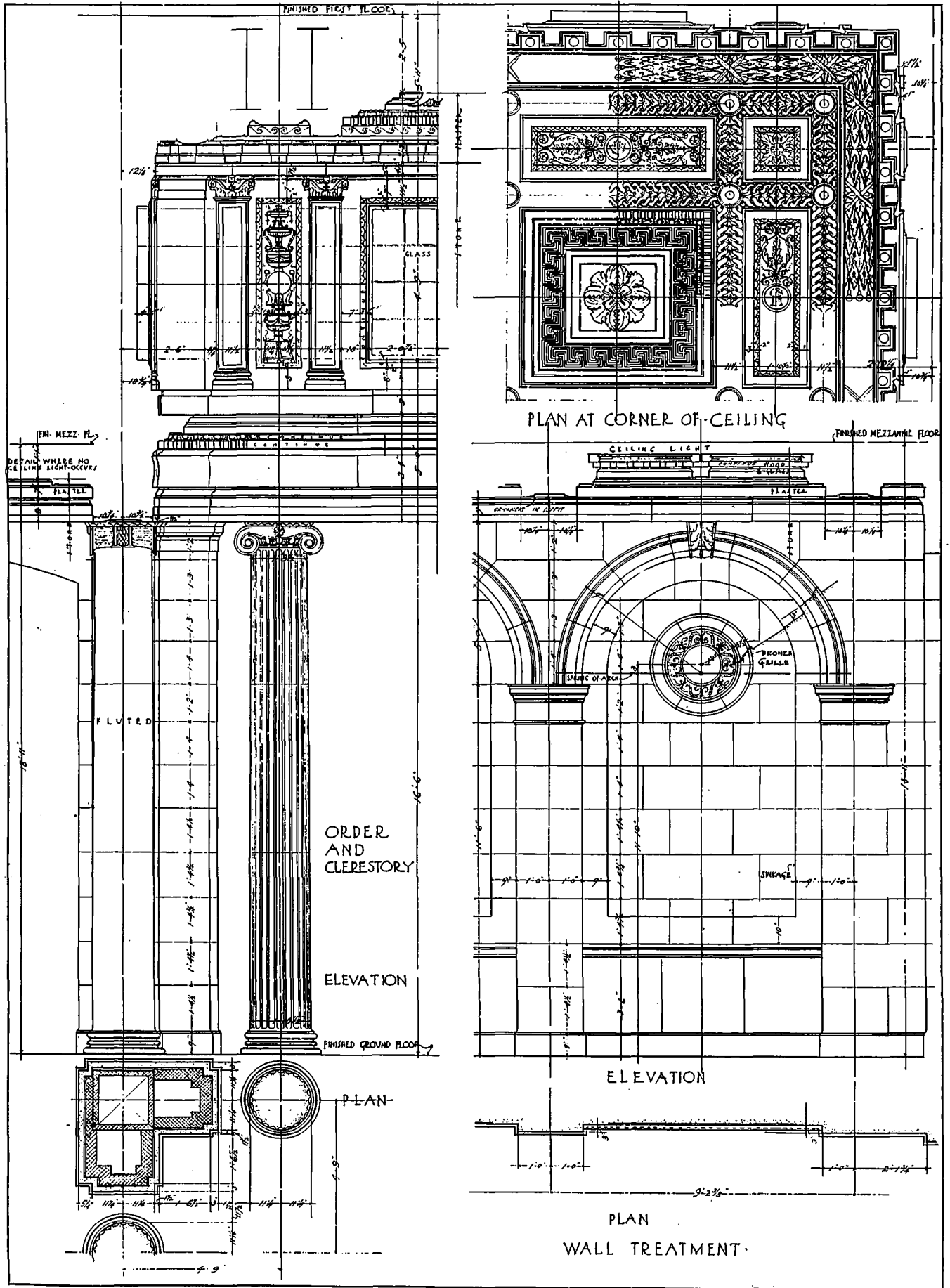
Ventilation of Banking Rooms.—The best results are obtained in rooms of this kind by the use of fans, both for supply and exhaust. The location of these will depend somewhat upon the arrangement of the building. Ordinarily the supply outfit is placed in the basement, although in some cases it may seem best to locate it above the rooms, and discharge the air into the flues leading downward. Vent flues from the first floor are usually gathered at the basement ceiling and connected with an exhauster discharging into a special shaft leading to the top of the building. There are various ways of admitting the warm air to the main banking room. If the system is to be used for heating only, and not for cooling in the summer time, it is a good plan to bring in a considerable proportion of the warm air through long narrow slots in the window sills, and through elevated registers in or near the outer wall. A certain amount should also be supplied to the public space by means of grilles along the inner wall or through centrally located columns.

Exhaust ventilation should be through grilles or registers placed near the floor, part in the

BANK OF BRITISH NORTH AMERICA, MONTREAL, QUE.

BAROTT, BLACKADER & WEBSTER, ARCHITECTS.





DETAIL OF MAIN BANKING ROOM.
 BANK OF BRITISH NORTH AMERICA, MONTREAL, QUE.
 BAROTT, BLACKADER & WEBSTER, ARCHITECTS.

base of the counter and part in both outer and inner walls, if the room is of considerable width. In long narrow rooms the fresh air is often brought in through a series of registers, about eight feet from the floor, located in the outer wall, and the exhaust taken off through openings near the floor along the opposite side of the room. An examination of the plans of a considerable number of the latest installations of this kind shows quite a variation in treatment as to the location of air inlets and outlets.

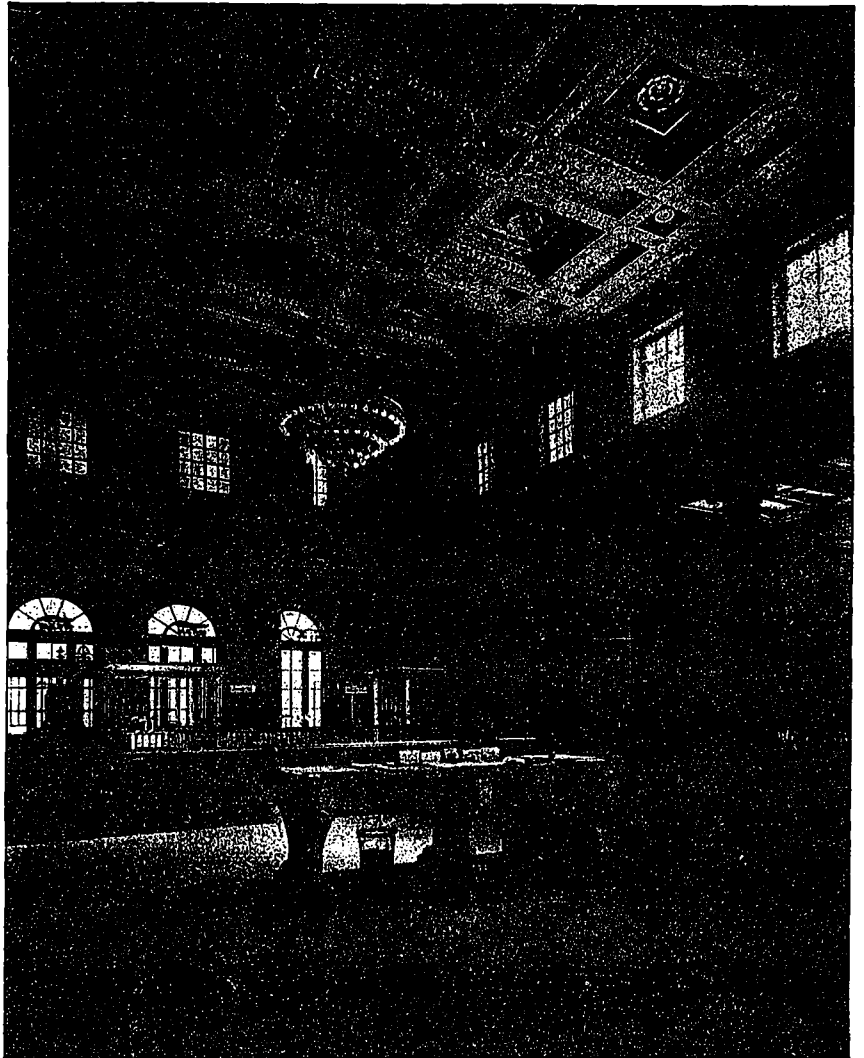
Much seems to depend upon the available space for flues, and the only general rule followed appears to be the admission of air at an elevation of seven or eight feet and its removal at or near the floor. In several of the plans examined, the larger proportion of both supply and vent registers were located along the same wall. When a washer or other cooling device is used, and the air is admitted in summer at a temperature considerably below that of the room, a somewhat different flue arrangement must be provided than noted above. Ordinarily the space along the outer walls, next the windows, is occupied by desks, and if the cooler air were admitted in the usual manner, it would at once fall upon the heads of those sitting below.

With systems of this kind the air should be introduced along the inner walls, or at the opposite side of the public space, and exhausted at the outer walls after having become diffused and raised to the normal temperature of the room. This arrangement works equally well with warm air, provided direct radiators and shields are placed in the windows. Whatever the method of ventilation, a sufficient number of direct radiators, or rotation heaters, should be provided to warm the room to a comfortable temperature when the fans are not running. In general, we may say that the air should be heated to about 72 or 74 degrees at the fan, and delivered to the room partly at this temperature and partly at a higher temperature by passing through re-heaters beneath the window flues, these being available as rotation heaters, when the fan is not running, by the manipulation of switch dampers.

Private offices may be heated by direct radiation, either encased or exposed, or by re-heaters

at the base of the supply flues. Sometimes direct radiators are screened and the air supply brought in back of them.

Volume of Air Supplied.—When the probable number of occupants is known, it is best to proportion the air supply upon this basis, allowing at least 40 cubic feet per minute each. When this information is not available, a certain number of changes per hour may be provided. Under ordinary conditions from four to five changes should be furnished in the smaller

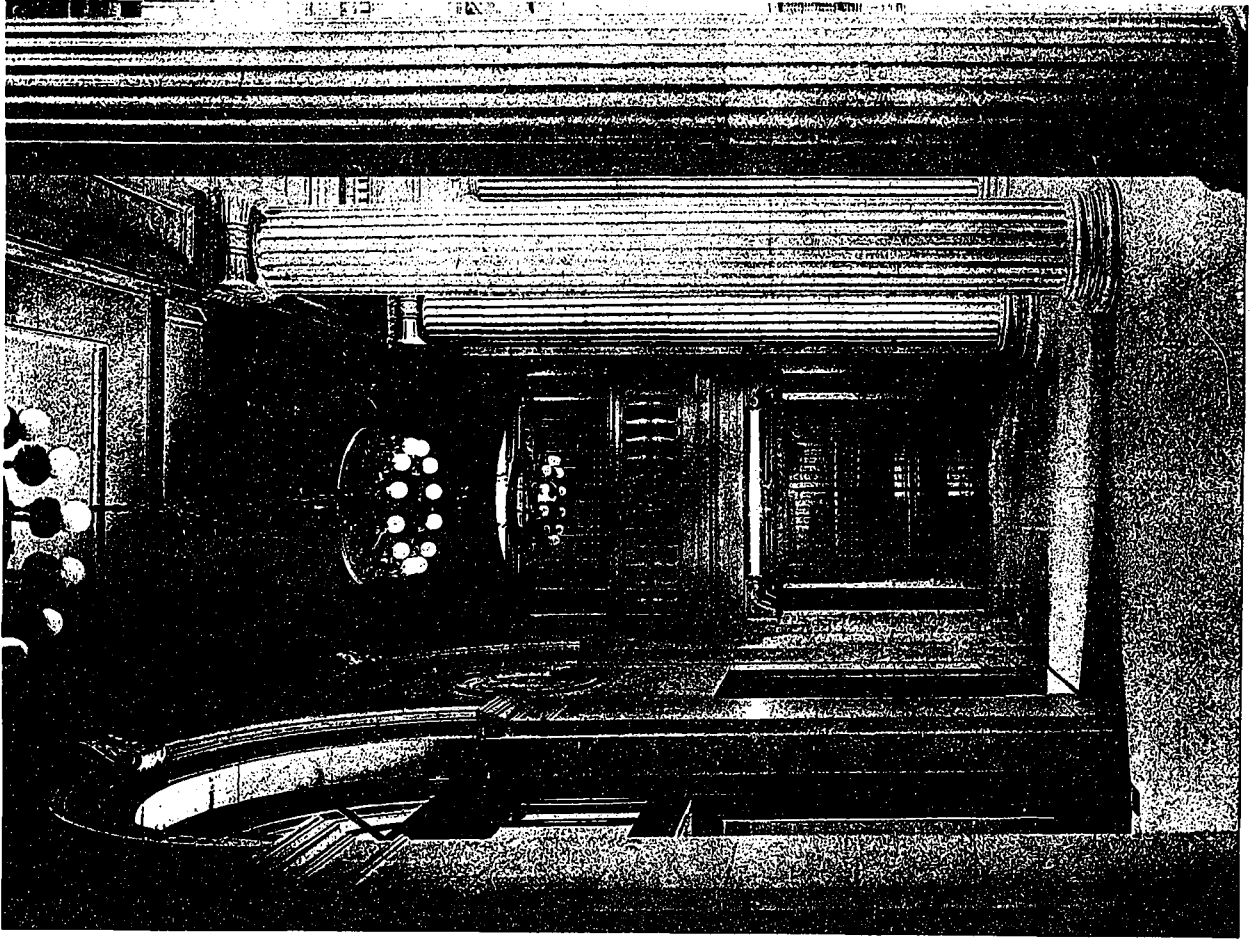


MAIN BANKING ROOM.

rooms of an office building and from three to four in banking rooms. If the rooms are very high, the number of changes may be reduced.

In a building recently erected, a banking room 58 feet in height was satisfactorily ventilated with two changes per hour. When designing a ventilating equipment for rooms of this type, the exhaust system need have a capacity only about 0.6 to 0.7 that of the supply system, as a considerable amount of air will find its way out by leakage.

Vault Ventilation.—Safety deposit and storage vaults require special treatment, because, when closed at night, there must



ENTRANCE LOBBY.



MAIN BANKING ROOM.

BANK OF BRITISH NORTH AMERICA, MONTREAL, QUE.

be no access whatsoever through the air ducts.

There are various ways of overcoming this difficulty. In one case a small centrifugal fan is supported upon the wall at the rear of the vault and arranged by means of a shallow ceiling duct to draw air from the upper part of the doorway. This air being taken from a well-ventilated corridor, and therefore of good quality, is delivered at several points in the rear and along the sides of the vault and passes out under a slight pressure through the lower part of the doorway. Another plan is to omit the special fan and connect with the regular ventilating system by means of a removable sleeve, which is disconnected at night when the doors are closed.

Ventilation of Special Rooms.—Exhaust ventilation is provided for toilets, kitchens, lunch rooms, etc., by means of separate fans, in order to make them independent of the banking rooms. Whenever a room is likely to contain smoke or unpleasant odors, the flow of air should be outward, hence a supply is usually drawn from the corridors and discharged outboard, instead of being furnished by a special supply fan under pressure.

Rooms of the above type require from five to six changes per hour under average conditions, and often more in special cases.

Air Washing and Cooling.—Air washers are now generally included in the ventilating equipment of all buildings of this type, both on account of the more healthful quality of the air supply and for protecting the building and its contents against injury from soot and dust. These devices are easily equipped for humidity control and may be used for air cooling in the summer.

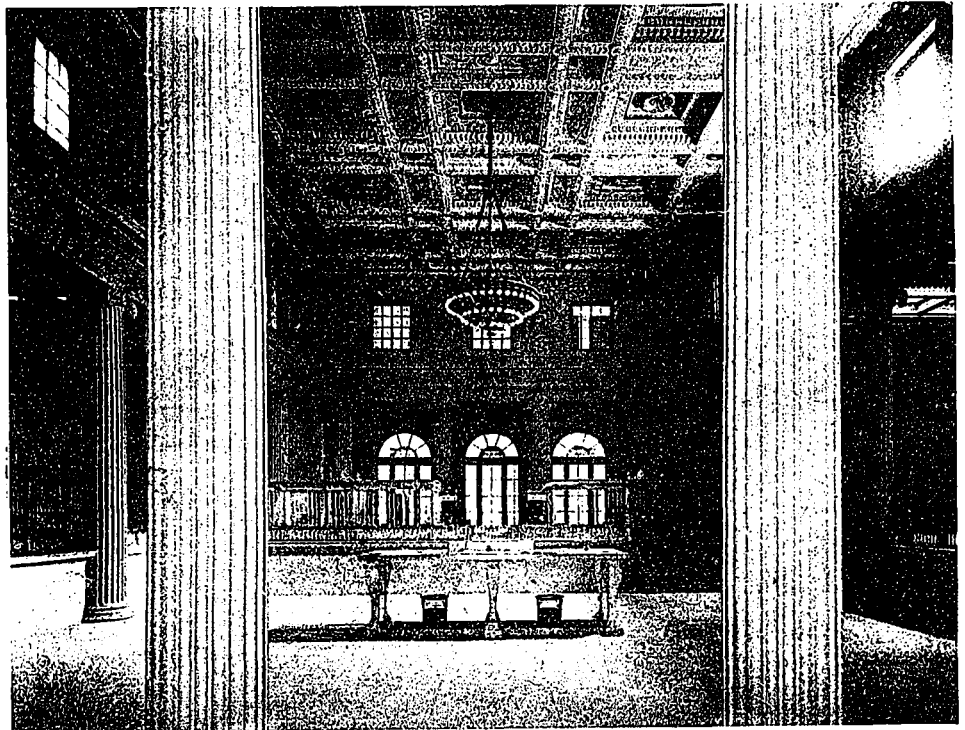
The amount of cooling effect will depend somewhat upon local conditions and may be increased by taking the spray water from the city mains or deep wells. In some cases a refrigerating plant is installed, and brine or other cooling medium circulated through the heating coils.

DAYLIGHT ILLUMINATION*

The illumination of buildings by natural light, as obtained by forming openings in the walls and ceilings of rooms, is an operation which so

materially influences the structure and the subsequent utility and value of all buildings, to say nothing of the architectural and other amenities, that one is rather staggered to find that practically no rules exist which determine what width, height, and arrangement of glass area will afford adequate illumination for any given size of room. Still more strange is it to find no recognized criterion in existence as to what is adequate natural illumination for any given purpose, such, for instance, as a school, a library, a dwelling-house an office, a retail shop, or a workshop.

By means of vertical windows we admit to our rooms a small proportion of the illumination enjoyed outdoors, but what that proportion



MAIN BANKING ROOM FROM LOBBY.

should be for any specific purpose has yet to be defined. When we come to consider the matter we find that the daylight source varies from month to month and from hour to hour on normal days by several hundreds per cent., whilst on many days it will vary by 50 per cent. to 100 per cent. in the course of a few minutes.

A thousand foot-candles of daylight or sunlight is less trying to our eyes than ten foot-candles of artificial light. This is possibly due to the fact that we have only been accustomed to the use of the latter for, say, 150 years or so—a period which is extremely minute in comparison with the countless ages through which our eyes have developed under natural light.

The eyes of many people are particularly susceptible to color, and if the walls of a room be covered with a white paper with a light-pink pattern, the eye, noting their cheerful lightness, will pronounce the room a light one,

*Paper by P. J. Waldram, England.

whether it really be so or not. On the other hand, if the walls be dull grey or brown, as in the Court-rooms of the Royal Courts of Justice, one is obsessed by their sombre gloom, and will find it most difficult to avoid the conclusion that the courts are dull and badly lit, even though by virtue of their high windows or lantern lights they may really enjoy a degree of illumination for reading and writing such as is received by very few ordinary rooms, and may be able to dispense with artificial light on a winter afternoon for a considerably longer period than would be possible in a room lit with windows of the ordinary height.

We must also make ample allowance for the fact that clear blue sky necessarily suggests the idea of unobscure sunlight which give the most intense degree of illumination which our eyes will stand; whilst on the other hand clouds indicate a material reduction of such light. But these are outdoor conditions, and as we have taken to living and working so much indoors our intuitive impressions are apt to prove deceptive unless we recognize that blue sky gives us very little of that diffused light upon which all interiors must depend when they are not



MANAGER'S SUITE.

receiving the sun's rays, direct or directly reflected. White or very light grey clouds, in fact, materially increase the illumination of interiors.

(1) Minimum Illumination. — Photometric data is needed to determine the value in foot-candles of minimum natural illumination required by average persons. It naturally varies for different purposes.

(2) Minimum Ratio of Inside to Outside Il-

lumination.—Some years ago the writer suggested that owing to the large and often rapid fluctuations of daylight the only exact photometric standard one could take was the ratio of the brightness of the zenith sky to the inside light; and that the only standard without instruments was the inside illumination enjoyed at sunrise and sunset on clear winter days, at which times the zenith sky is of at least approximately similar brilliance. This is really a very low criterion, the brightness of zenith blue sky being then only about 100 foot-candles in round figures. It is seldom darker than this between sunrise and sunset, and is generally much brighter even on wet days in winter in towns. Between sunset and sunrise, or when the sky is, in abnormal weather, darker than 100 foot-candles, it would appear to be unreasonable to expect any room to be lit by daylight. It must be noted that the light at sunrise or sunset with a clear sky is increasing or decreasing rapidly. It would not be correct to make such a test at, say, Plymouth without allowing for the fact that the sun there rises or sets sixteen minutes later than the calendar time owing to 4 deg. of west longitude. Any

test should, of course, be made at sunrise in rooms facing west and at sunset in rooms facing east.

For offices and domestic apartments the following ratios were suggested, viz.:—That the requirements of ordinary comfort cannot be said to be infringed at any point where it was possible to read at sunrise and sunset on a clear winter day. This is equivalent to a ratio of 0.1 per cent. (1-1000) of the light derived from a small portion of the zenith sky; 0.2 per cent. of the total light from an unrestricted full hemisphere of sky of the same brightness, such as would be observed on a white card placed on a

roof under a uniformly grey sky, and 0.4 per cent. of the illumination falling on a white card on the window sill with a free horizon.

For schools it would appear that the desirable minimum is somewhat in the neighborhood of two and a half times as much as in offices—viz., that the darkest desk should receive $2\frac{1}{2}$ thousandths (0.25 per cent.) of the zenith light, 0.5 per cent. of the roof light, or 1 per cent. of the light on the window sill with a free horizon.

This is equivalent to saying that at sunrise

or sunset in a clear winter sky, or at other times when the sky has an apparent brightness of, roughly, 100 foot-candles, the worst part of an office should receive a minimum of one-tenth of a foot-candle and the worst desk in a school one-fourth of a foot-candle.

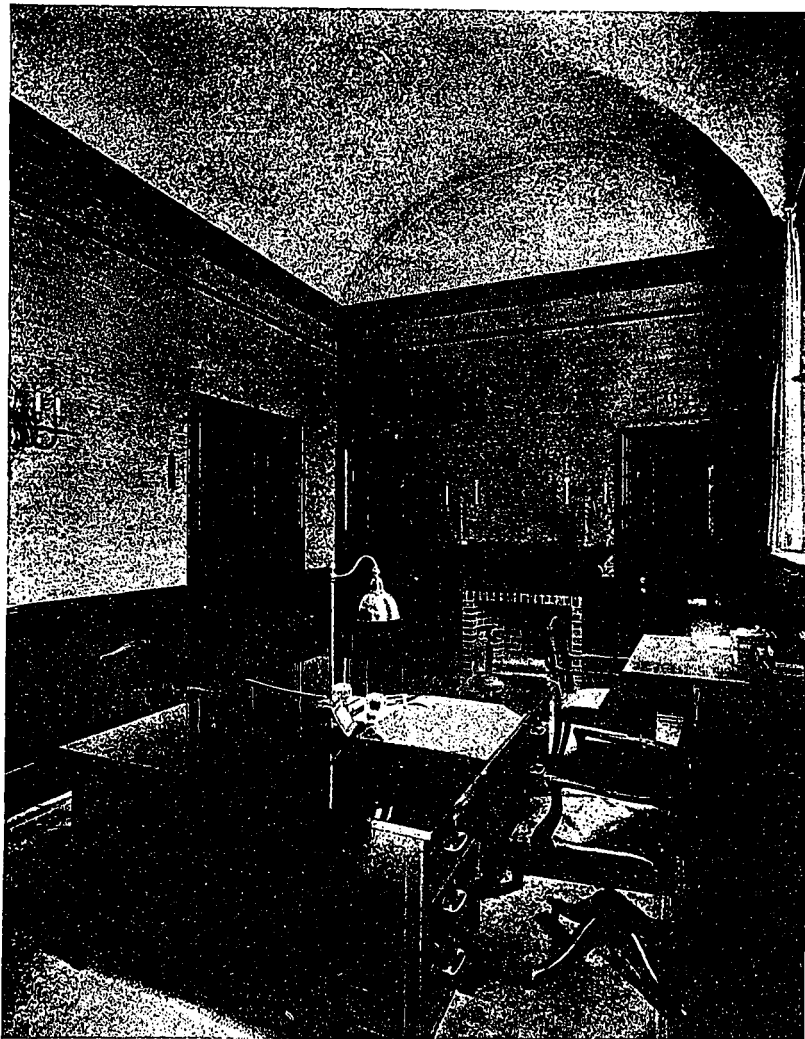
(3) Relative Lighting Value of Different Elements of Sky.—The writer suggests that this important and even fundamental data can be most easily obtained by placing a large spherical wire cage outside the window of different model rooms and ascertaining the effect upon any given part of the interior produced by blocking out alternative angular divisions of sky. Possibly the relative values thus found might be identical for all ordinary conditions, possibly certain elements might be more valuable in some cases than in others; but even in the unlikely event of a number of different sets of ratios being found to be necessary for different conditions of window height and width to depth and width of room they could easily be printed in the different angular squares of similar diagrams on tracing-paper, the appropriate tracing selected, and the true value of the actual sky lost and retained in any case could be at once computed.

Only when we really know the different lighting values of different elements of sky can we determine what degree of obstruction will affect any user of given premises. The determination of this obviously affects huge sums, not only of private expenditure, but also of public funds, as in the case of schools, where it is often necessary to determine whether old buildings shall continue, whether they can be improved or must be rebuilt on a new site, and whether they may be extended on the same site to cope with the needs of growing districts.

With regard to this important point, the amount of experimental data available is also very meagre. Tests of the daylight illuminations on a card placed at different parts of rooms first when obstructed and then when shaded with a small card which just blocks out direct light from the window glass and leaves only the reflected light tend to show, as would be expected, that at and beyond the "effective range" of a window light reflected from the walls and ceilings, especially the latter, is a much larger proportion of the total light available than it is in positions nearer to the window, although it is naturally greater there. The writer has not, however, had time to make suffi-

cient numerous tests on model rooms papered in different colors to be able to give any definite opinion as to the necessary co-efficient reflection in walls and ceiling paper which is essential to keeping any part of a given room up to a given standard.

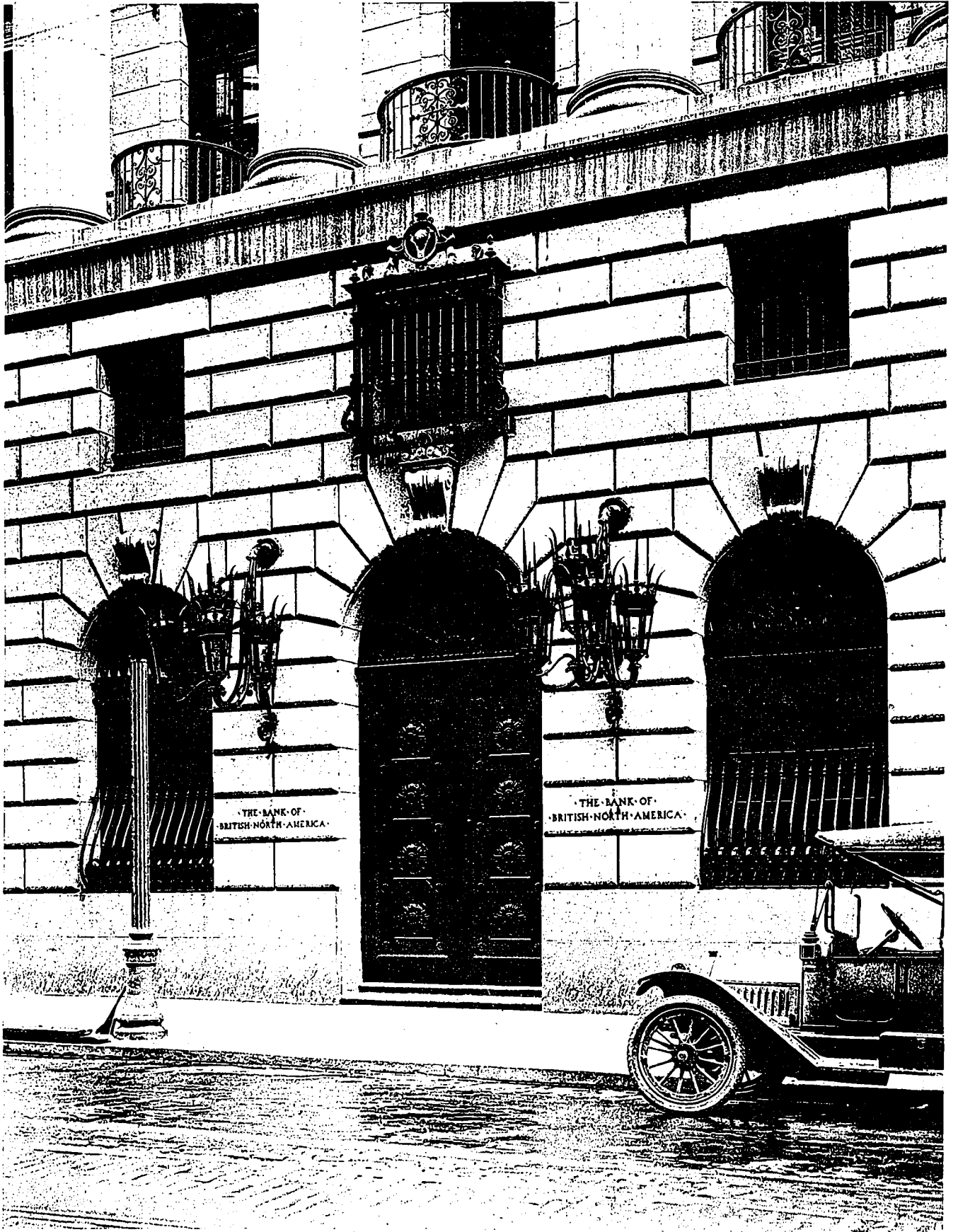
The collation of sufficient data to determine this problem from actual rooms would be a



OFFICIAL SUITE.

stupendous task, and it is indeed fortunate that the daylight conditions of rooms are exactly repeated in scale models in which the effect of different arrangement of window space, wall surfaces, and sky obstruction can be studied at a minimum expense. It is also more than probable that an artificial sky could be reproduced by a hemisphere of cotton-wool on a wire framework which would give the same photometric readings under artificial light, as a uniformly grey sky; and thus materially reduce the extent of experimental labor, which might otherwise be so tedious that comprehensive results would be almost prohibitive.

With regard to the proper width of window for a given width of room, and the relative value of lateral sky for lateral lighting, writer has as yet made but few observations.



ENTRANCE DETAIL.

BANK OF BRITISH NORTH AMERICA, MONTREAL, QUE.

BAROTT, BLACKADER & WEBSTER, ARCHITECTS.

Standardization of Drainage Tests and Certificates

G. BERTRAM HARTFREE *

IN testing drains, the common practice is often one or other of the following extremes: Solely by smoke test (and for which only a single smoke case may be used); this may detect a serious leakage, but in no event, unless the pipes are uncovered, can a negative result be taken as a proof of soundness of pipes; the alternative is the pressure hydraulic test, which is unfair unless the owner's consent has first been obtained, after fully explaining its nature and effects. Many sanitarians advocate that old as well as new drains should be required at all times to withstand this test; were this common practice, the condemnation of stoneware drains and substitution of heavy pattern cast-iron pipes would result, as experience, with over a thousand drains, has shown that very few, if any, stoneware pipes will withstand such pressure. The best found, which had been laid ten years, sixty yards in length, and pipes with the original Stanford joint, had but three leakages, which were small.

The sanitary engineer, dealing with an existing drain, faces the problem of accurately obtaining information for the purpose of advising his client (the intending occupier) without injuriously affecting the property of the other party. Should a pressure water test be decided on, this should be limited to such head as would operate at any point in case of stoppage, unless a special covenant to a greater head be agreed upon. The practice of plugging all inlets and testing with a head of water equal to the height of a water closet above the ground floor is, in the absence of an agreement, unfair, as the drain under no condition would be subjected to this pressure, and in the absence of the owner's consent might lead to action for damages. A test rarely applied, but exceedingly useful when pressure is to be applied, is by compressed air, which gives uniform pressure throughout the system. This can be applied excessively; in fact, with stoneware pipes it may be taken that it is an easy matter to increase pressure with air or water and cause a failure; but compressed air applied in moderation has much to recommend it, and in the absence of special conditions I would have no hesitation in approving, as sound, any stoneware drain that withstood for half an hour an internal pressure of one pound to the square inch.

When pressure tests are not specified, common practice is to apply one of the following: (1) Smoke test by case or machine. (2) Chemicals. (3) Colored or measured water. These are useful for particular purposes, but although the test appears satisfactory, it is no proof of a safe drain. Should a smell be presumed to arise from an indefinite spot, the chemical test may be useful in proving the presumption and localizing a particular point; the smoke test may make it visible, but these without some other proof are no guarantee that leakages, small or large, do not exist. As an example, a drain, which from other tests was known to be defective, but which, subjected to smoke under pressure on six separate days, showed an escape on one occasion only. This variable result may be attributed to several causes. Atmospheric conditions largely affect smoke, and the practice of plugging up all openings before applying this test is to be deplored, as experience shows that generally the whole volume passes to a particular direction and the remainder of the system is uncharged. In consequence, no outlet should be stopped until the normal air is replaced by smoke-laden air. Another point to be borne in mind is that smoke naturally rises, and a downward leakage towards a water supply remains undetected. Colored liquids are often used for the latter purpose: it is a lengthy procedure hunting for possible leakages from drains to water supply, and a true negative result can rarely be obtained by the process; for, as with smoke, a saturated earth may not pass the reagent, although when the soil is dry pollution takes place; *vice versa*, a dry earth may absorb the testing liquid, but, with its absorbing capacity reached, contamination of water supply follows. I have on record one instance of a drain that withstood a pressure due to a head of eighteen inches at a particular point, but owing to a defective gradient was relaid, and the cement joints, upon opening the ground, were found cracked, a large amount of grease and soap passing through, having filled the crevices, secured them against a water test.

The use of colored water, as generally practised, is to ascertain the courses of pipes or the presence of stagnant faecal matter. Although rarely used, the best method is to first flush the drains with clear water and then pour down a light pink solution of permanganate of potash,

*Paper read before the R.S.I., England.

this having a distinct advantage over other colorings, as foulness causes a chemical reaction resulting in a brown coloring. By increasing the proportion of the chemical, and by observation and practice, a good general idea of the internal condition of drains can be ascertained. Except when drains are very defective, the measured water test is of little use, owing to the difficulty of ascertaining at the lower end the exact quantity of water arriving, but is desirable in conjunction with other tests when low pressure is applied.

Three grades for purposes of standardization are proposed: high pressure, medium pressure, and low pressure. In comparison with these, the test applied by the local health department may be described as non-pressure. It is presumed, in connection with the high-pressure test, that the drains will be required to withstand any future test that may be applied; consequently hydraulic standard cast-iron pipes jointed with molten lead must be used and made to withstand a compressed air test not less than ten pounds to the square inch, the invert so true that with a diameter of four inches a three-and-a-half inch vulcanite ball, placed in the highest part of the drain, will by its own weight roll to the outlet of the section.

For a medium-pressure test: air compressed not less than two and one-half pounds to the square inch, or water with a minimum head of two feet is applied, and the vulcanite ball required to pass through after receiving a reasonable propulsion.

The application of a low-pressure test, that shall be equitable to the interests of owner as well as occupier, is difficult but not impossible, and can be carried out in the following manner: A point of access at the lowest end of the system is imperative; from thence, the drain having been well flushed and the results noted, the low-pressure air test is applied, first stopping all untrapped openings, as well as the drain at testing point, at which a plug is connected to a long rubber tube, through which a pressure of air, insufficient to unseal the traps, but enough to displace the water in the U-shaped gauge of the apparatus, is applied. Generally, blowing in a detached end of the tube, pinching the same and forcing over the open end of U gauge is practised, but a better course is to use a small pump. This overcomes the objection to contact to mouth from drain, and also enables the level of displaced water in the gauge to be raised to a definite height. According to the time the water remains stationary in the gauge, so the condition of the drain may be taken, with long lengths; some time will be taken to obtain sufficient pressure, and it must be remembered that a loose inspection cover will defeat the test. This will illustrate the important fact that often

after the expenditure of large sums in making drains to withstand higher pressures, the object is defeated by cheap, improperly fitting covers.

It is claimed for some smoke machines that they can be used for both low pressure air and high pressure smoke tests; possibly with great care this may be done, but their cumbersome make is an objection to general use, and, unless constantly cleaned, carbon deposits in the tubes cause irregular results. Following the air test smoke should be applied, as it is important, even with sound drains, that the ventilating openings be tested to ascertain that they are free, especially when they are not protected by wire domes. For the purpose of obtaining the fullest information colored water should be applied, followed by passing (floating or washing) a sphere, the diameter of which should be at least three-quarters that of the pipes, and in the event of obstruction, by the use of rods or mirrors further information can be obtained. The foregoing test is not recommended for systems the previous history of which is unknown, but where a reliable certificate has been obtained as to a successful medium pressure test, it is generally sufficient to satisfy the requirements for stoneware drains.

A private drainage report should be headed with a brief description of the grades of tests that may be applied, and a certificate should be treated in a similar manner, or should refer to a specified report.

In case of low-pressure test the water supplies need most careful examination, especially when on the same site; and in such event it may be desirable to recommend that some portion of the drains be made to withstand a higher pressure if there be any possibility of future stoppage of drains causing contamination of a well. Even when drinking water is from a safe source, a rain supply intended for washing must be carefully considered.

Concise drainage certificates are advantageous, but in the interests of all parties concerned they must contain detailed particulars of tests applied, and refer to any previous report.

In conclusion, I trust I have proved: (1) That it is far easier to apply a test that will condemn a drain than one that will show it to be reasonably sound; (2) by adopting standard tests there would be little difference in the separate reports of two competent persons, which would remove the present vexation to owners and their agent who, having previously been put to considerable expense to satisfy the adviser of one tenant, finds these requirements condemned on behalf of a subsequent prospective occupier; (3) if the "water test" is at all times a reasonable test in the absence of a special agreement, the use of ordinary stoneware drain pipes represents money wasted.

Panama-Pacific International Exposition, San Francisco

ON February 20, 1915, the Panama-Pacific Exposition at San Francisco was formally opened, and more than four hundred thousand people celebrated the beginning of a new epoch. Held in honor of the greatest engineering accomplishment in the world's history, it is quite pleasing to see the consistent effort put forward to make the Fair a worthy one in every respect. Covering 2,663,183 square feet of area and representing an expenditure of \$300,000,000, it is spoken of universally as the greatest achievement in the art of building.

In planning the exposition it was decided to divide the buildings into three principal groups, massing the great exhibition palaces in the centre, while the pavilions of the nations, and State buildings, lie to the west and the amusement section, the "Zone," is located nearest to the heart of San Francisco. The base of the central group is a great quadrangle composed of eight immense exhibition palaces, similar in character and separated by three great courts running north and south between the three pairs. In the centre is the vast Court of Honor, the Court of the Universe; on the west is the Court of the Four Seasons; on the east is the Court of Abundance. Huge colonnades screen the walls of the buildings, extending from the openings of the courts upon the harbor back to the courts themselves, and almost encircling them. The walls of these vast corridors are red, their vaults Venetian blue. Red, blue, green, and golden brown in pastel shades line the recesses in the courts, silhouetting in color great groups of statuary placed within niches. Superb mural paintings by William DeL. Dodge, Frank Brangwyn, Milton H. Bancroft, Edward Simmons, and other famous artists,

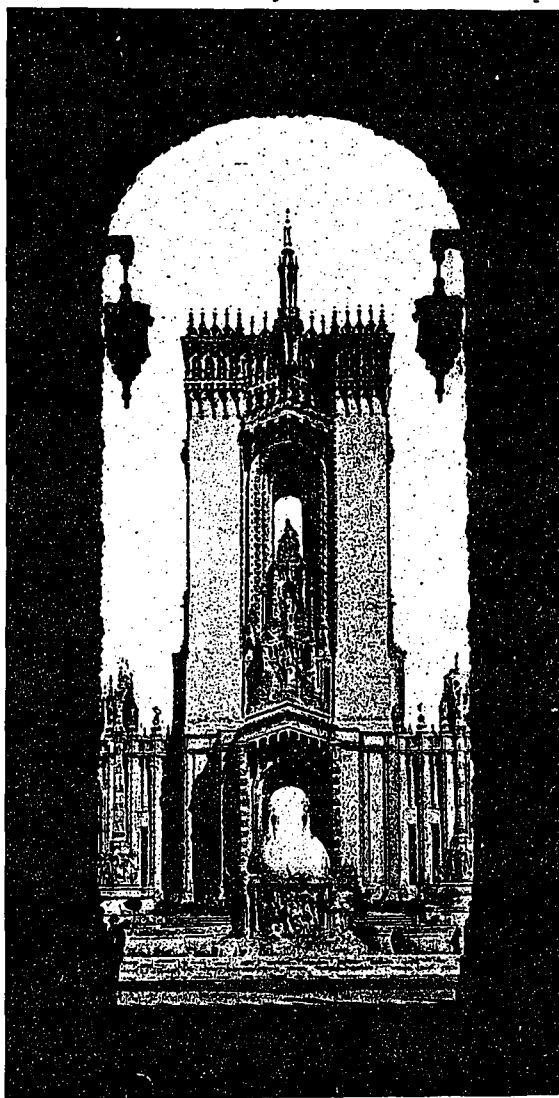
have been placed upon the walls of the courts behind the colonnades or upon the vaults of great triumphal arches.

The huge domes rising from the centre of eight of the main exhibit palaces are their most conspicuous architectural feature. These domes rise 160 feet above the floors of the buildings, are 100 feet in diameter and are set upon great octagonal bases that rise at the intersections of transverse and longitudinal naves that run through the centres of the palaces. The lattices in the bases beneath the domes are of green with glints of gold showing between their intersections.

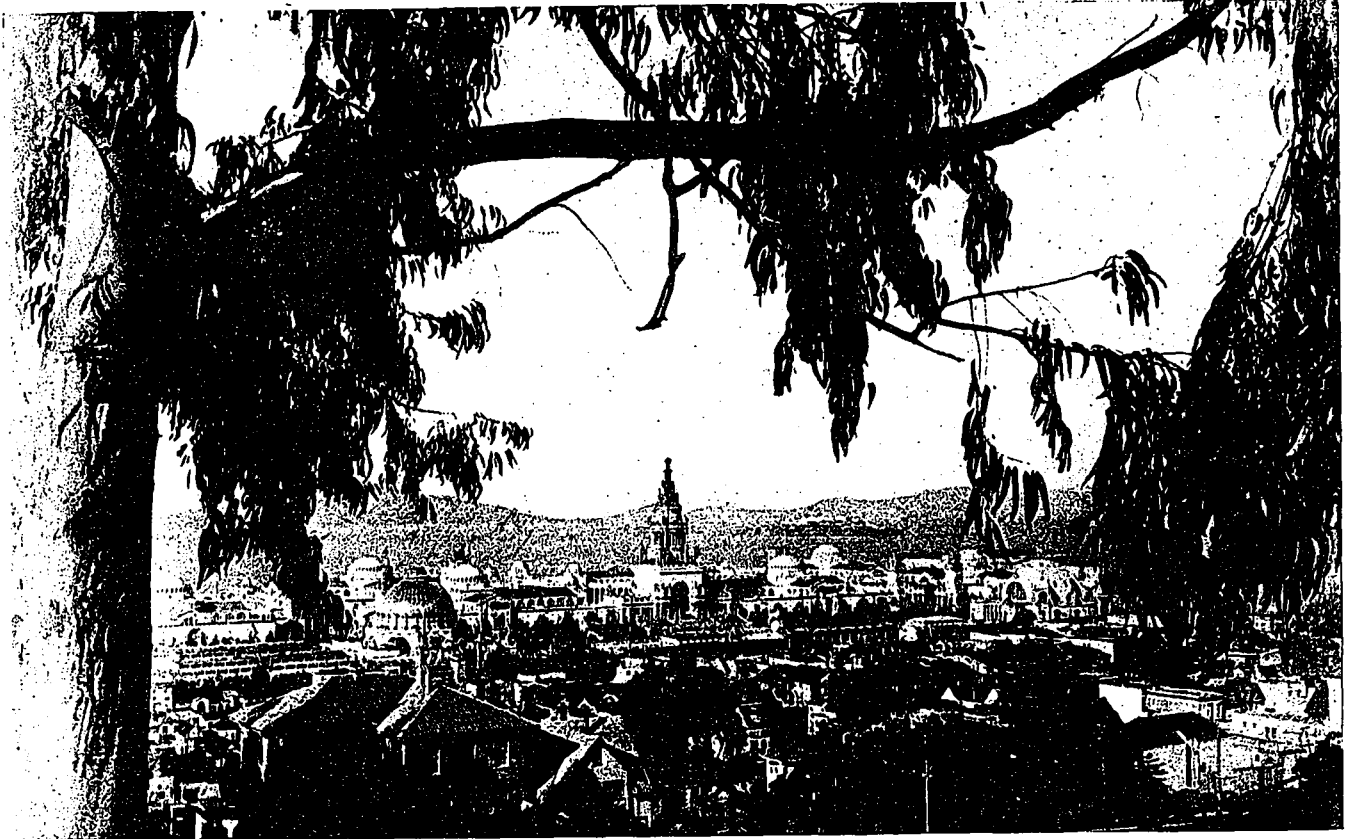
To the south of this group of buildings is the beautiful South Garden, flanked on one side by the wonderful Palace of Horticulture, with its Saracenic architecture suggested by the Mosque of Sultan Ahmed I; and on the other by the magnificent Festival Hall. To the west of the main group is the Palace of Fine Arts, a creation that well merits its name.

The central architectural feature of the grounds is the Tower of Jewels, a Babylonian effect that rises 435 feet high by a series of seven decorative terraces, and is surmounted by a triumphal group of figures supporting a globe, typifying the world. Suspended upon its walls are 125,000 "jewels" of cut glass that scintillate in the sun, and at night glis-

ten and radiate multitudes of beams reflected from the many colored lights that are arranged to play upon the tower, as well as most of the other principal buildings. Through the base of this tower entrance is given to the Court of the Universe by an archway 125 feet in height, and set within a vast colonnade in its base are the two great fountains, the Fountain of El Dorado and the Fountain of Youth.



ORGAN TOWER, COURT OF ABUNDANCE.



EXPOSITION GROUNDS, FROM THE PRESIDIO.

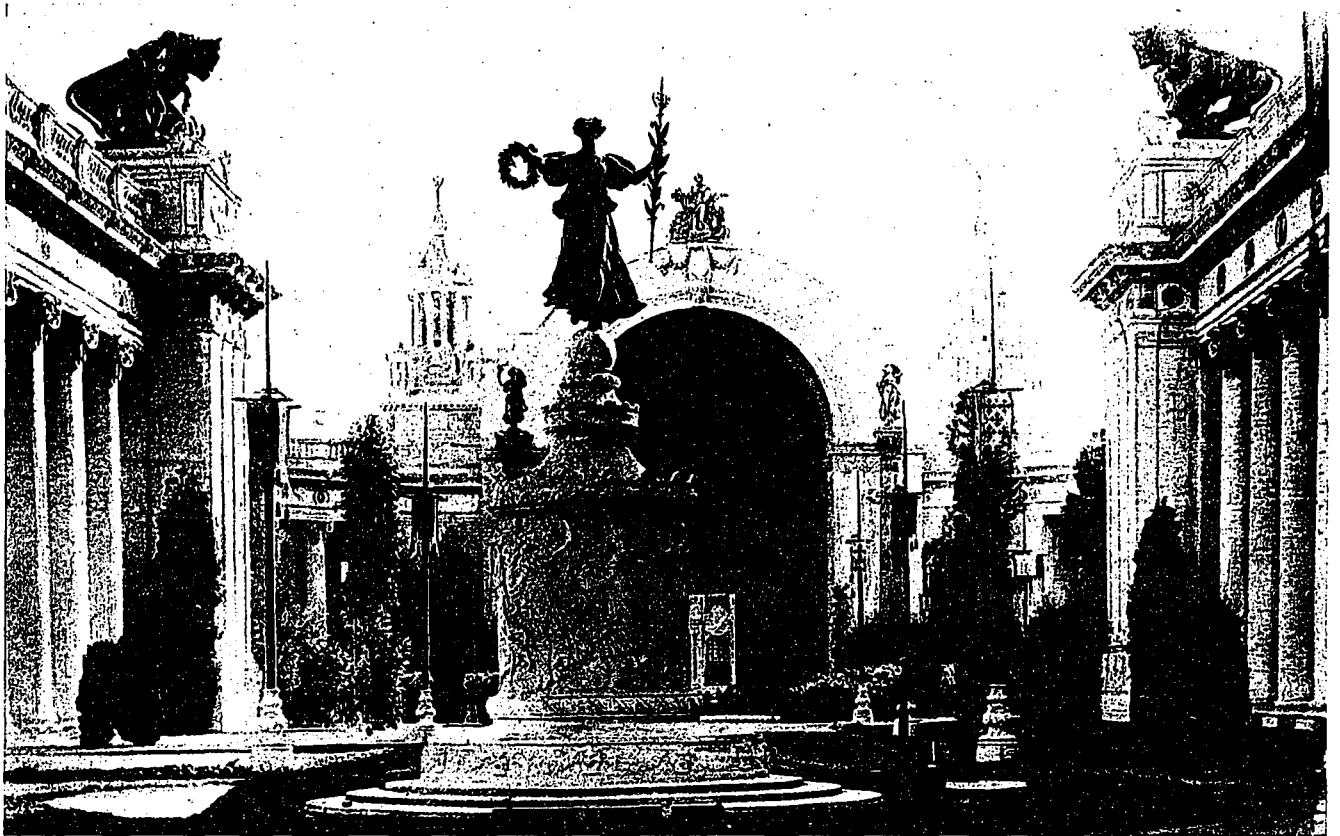
Contrary to general expectation, the architecture of the exposition buildings is not of the Mission style, but the prevailing character is rather the Italian Renaissance and Greco-Roman. There is, however a flavor of Spanish architecture, but of the highly ornate High Renaissance Spanish style, and the Hispano-Moorish. Decorative detail has been used with a lavish hand, but also with taste and judgment, and days could be spent in studying and admiring these subordinate features alone. Upon the architectural effects and details the best thought of the country has been bestowed, and the results have surpassed anticipation.

The general character of great fairs has tended to settle into certain general lines, but in the case of the Panama-Pacific the richness and variety of the architecture and the luxuriance of the decorative detail preclude all possibility of an impression of sameness, while a special feature of the decoration gives the exhibition as a whole a daring character of novelty and a beauty that is individual.

The special feature which gives a startling beauty and brilliancy to the entire scene, is the introduction of color, not for an occasional contrast, but everywhere, and making the whole scene poly-chromatic. We know that the Greeks in their most beautiful creations did not rely on form alone for their effects, but used colors liberally, not only in their architectural work, but in their sculpture, and this is the plan adopted at San Francisco. Early in the pre-

paration of the plans the management called in Jules Guerin. He has wrought on this six hundred and thirty-five acre canvas a harmonious picture, vivid in color and beauty. In contrast with other similar undertakings there are here none of the great familiar areas of white showing up on every side, for white has been entirely eliminated from the color scheme everywhere. In its place we have the marvelous blending of brilliant shades of red, orange, and blue with the green of the trees and shrubbery and the soft, warm buff of the walls of the buildings, for this shade has been adopted as the universal tint for all of the large blank surfaces. The many domes are gold and copper green, while the roofs show in some places the old red Spanish tile, while others are cerulean blue. The capitals and friezes are picked out in gold, blue, and orange, while the colonnades show pleasing contrasts of warm buff against Pompeian red.

These colors are not applied as paints or stains, but as pigments mixed with the material of which the surfaces of the buildings are composed; and this is of the character of cement rather than of the once familiar "staff," for which reason the colors are not as easily or as quickly affected by the weather. Furthermore, the surfaces have a natural stipple character that softens the color effects and eliminates all disturbing reflections. Cunningly arranged in the decorations of capitals, and in the flutings of columns, are numerous electric lights, which, with the many searchlights distributed about the grounds, illuminate the buildings at night and startlingly bring out their beauties.



THE ART EXPOSITION

COURT OF THE FOUR SEASONS.

The following description is taken from a critical review by Eugen Neuhaus, who is assistant professor of decorative design at the University of California, and member of the International Jury of Awards in the Department of Fine Arts of the Exposition:

It is generally conceded that the essential lesson of the Exposition is the lesson of art. However strongly the industrial element may have asserted itself in the many interesting exhibits, no matter how extensive the appeal of the applied sciences may be, the final and lasting effect will be found in the great and enduring lesson of beauty which the Exposition so unforgettably teaches.

The visitor is at once stirred by the many manifestations of art, presented so harmoniously by the architect, the sculptor, the landscape architect, and the painter-decorator, and his attention is kept throughout by artistic appeals at every turn. It must be said in the very start that few will realize what is the simple truth—that artistically this is probably the most successful exposition ever created. It may indeed prove the last. Large international expositions are becoming a thing of the past on account of the tremendous cost for relatively temporary purposes.

There is still much of the popular conception abroad that the West has only very recently emerged from a state of semi-civilization inimical to the finer things of life, and to art in particular. But we may rest assured that the

fortunate outsider who allows himself the luxury of travel will proclaim that the gospel of beauty has been preached most eloquently through the Panama-Pacific International Exposition.

The critic who prefers to condemn things will find small opportunity here, no matter how seriously he may take himself.

The first sight of that great mosaic, from the Fillmore street hill, at once creates a nerve-soothing impression most uncommon in international expositions, and for that matter, in any architectural aggregate. One is at once struck with the fitness of the location and of the scheme of architecture. Personally, I am greatly impressed with the architectural scheme and the consistency of its application to the whole. I fear that the two men, Mr. Willis Polk and Mr. Edward Bennett, who laid the foundation for the plan, will never receive as much credit as is really due them. I hope this appreciation may serve that purpose in some small way.

It was a typically big Western idea, an idea that as a rule never gets any further than being thought of, or possibly seeing daylight as an "esquisse"—but seldom any further than that. The Burnham plan for San Francisco was such an unrealized dream, but here the dream has achieved concrete form. The buildings as a group have all the big essential qualities that art possesses only in its noblest expression. Symmetry, balance and harmony work together for a wonderful expression of unity, of oneness, that buildings which are wholly de-



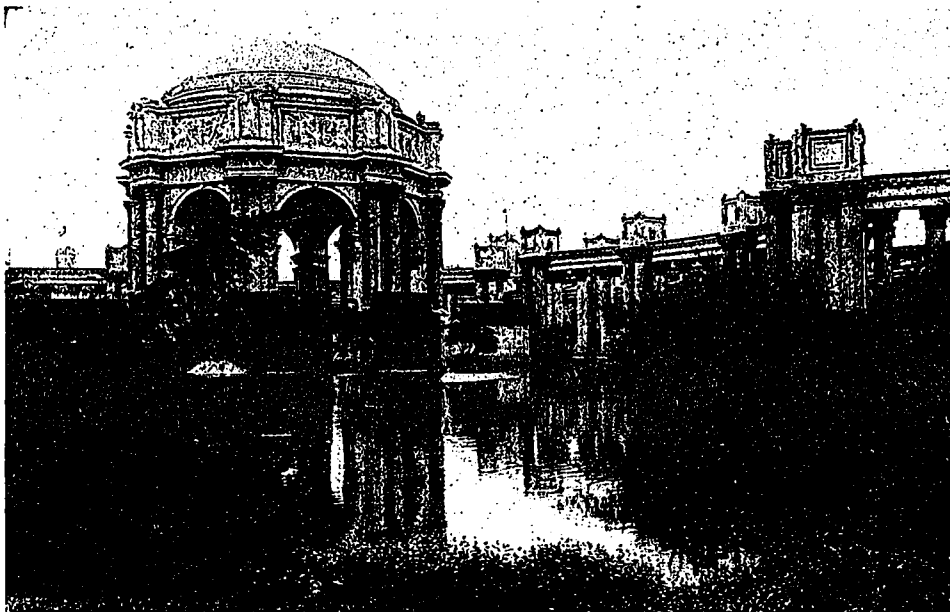
PROMENADE BEFORE THE PALACE OF FINE ARTS.

voted to profane purposes seldom show.

I do not know how many people who visit the Exposition are so constituted as to derive an aesthetic thrill from artistic balance, but I imagine that any person, no matter how inexperienced in matters of art, will rejoice at the fine feeling of orderly arrangement of major forms which runs through the entire grouping. It is simplicity itself, and it serves an excellent practical purpose, enabling one to visit the Exposition without being left a nervous wreck at the end.

The main entrance leads one into the physical centre of the Exposition. From there, on the first visit, one realizes the existence of an equally large area on either side, covered with objects of interest.

The main exposition, composed of a compactly arranged group of large buildings of



PALACE OF FINE ARTS.

approximately equal size, is symmetrically placed on either side of the main central court, the Court of the Universe. This sends out its avenues into two equally proportioned side courts—the Court of the Four Seasons on the west and the Court of Abundance on the east. While the main court rests right in the centre of the eight buildings, the side courts fit snugly into the centre of the four buildings on either side. This arrangement of large masses, comprising the bulk of the Exposition, creates a

grateful feeling of repose and of order, without being in the least uninteresting, for while there is perfect symmetry, on the one hand, in the larger masses, there is plenty and ever changing variety in the minor architectural forms and embellishments. The same balance, the same interesting distribution of architectural masses, continues on either side of the main building. In Machinery Hall, on the one hand, and the Fine Arts Palace on the western side, perfect balance is again maintained. That is, however, not the end of it all. Loosening up in a very subtle way, we find cleverly arranged the buildings of the various States of the Union and of foreign nations on the western side of the Fine Arts Palace, while at the other extremity of the main group, screened by Machinery Hall, is the amusement section, officially labelled "The Zone."

I do not suspect that the Zone is intended to give any artistic thrills. If so, I would propose to call it "The Limit," and so I drop it as a subject for further artistic reference. It is invaluable, however, as an object lesson in showing the fatal results of the utter disregard of all those fundamental laws of balance, harmony, and unity so uniformly and persistently applied through the seriously designed main body of the Exposition. There is no harmony whatever in the Zone anywhere, either in the form, style, or color, unless it be the harmony

of ugliness which is carried through this riotous

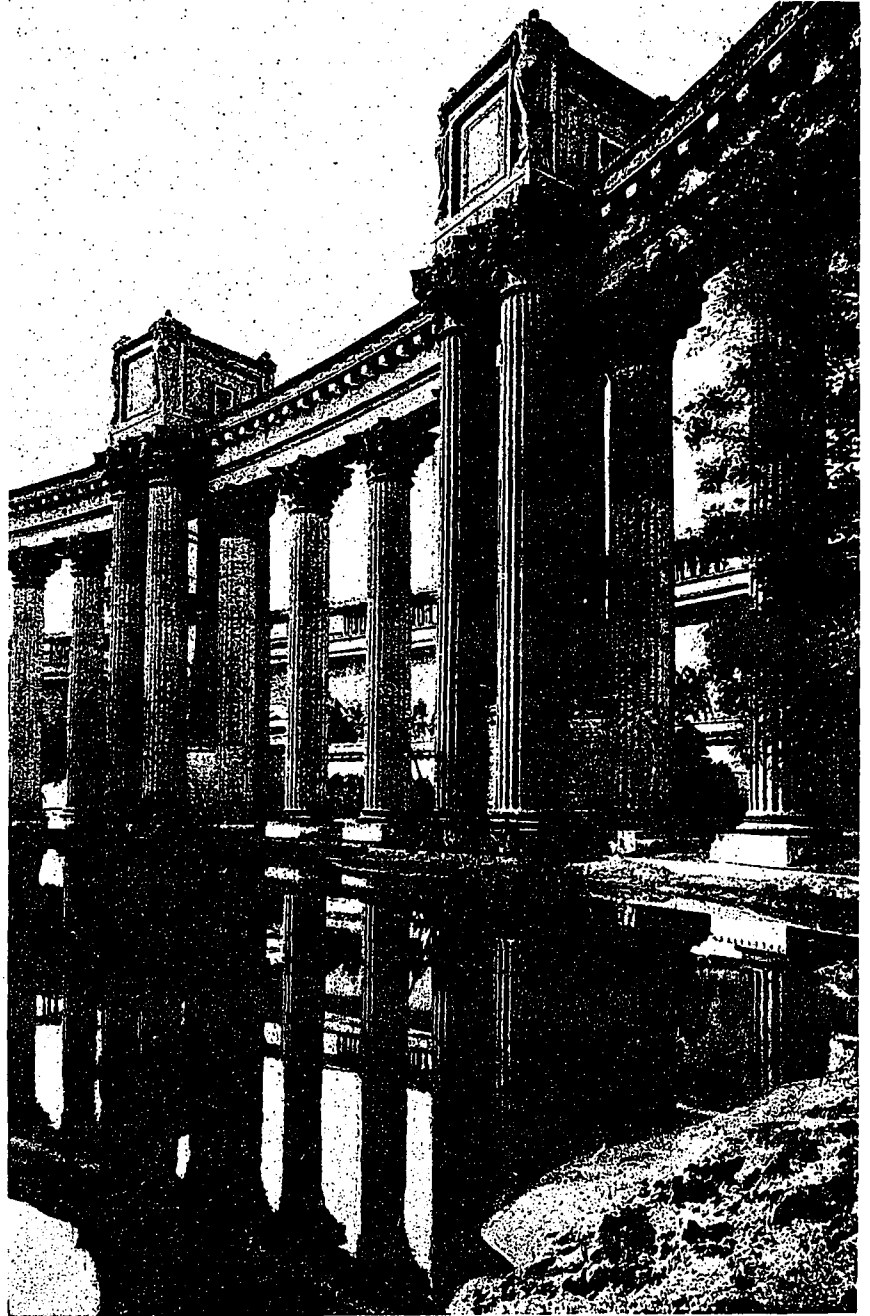
melee of flimsiness and sham. I cannot help but feel that this hodge-podge will convince the most doubting Thomas who might believe in the mob rule of hundreds of conflicting tastes. The Zone is not an improvement on similar things in former Expositions. Save for certain minor exceptions at the entrance, it will serve as a wonderfully effective illustration of the taste of the great masses of the people, and as a fine business investment.

So far, we have moved only along the east and west axis of the Exposition. The north and south development is not without its charm. The terraced city of San Francisco, on the south, without a doubt looks best on a densely foggy day. With its fussy, incongruous buildings—I hesitate to call them architecture—it serves hardly as a background for anything, let alone a group of monumental buildings. The opposite side, where Nature reigns, atones for multitudes of sins that man committed on the city's hills. But how great an opportunity there was lost! There are, however, some indications at the western end of Broadway that give fine promise for the future.

The bay and its background of rising hills and blue mountain sides provide the wonderful setting that so charmingly holds the Exposition. The general arrangement of the Exposition pays its respects to the bay at every possible angle. The vistas from the three courts towards the bay are the *pieces de resistance* of the whole thing. It was a fine idea, not alone from an economic point of view, to eliminate the two arches which appeared in the original plan at the end of the avenues running north from the Court of the Four Seasons and the Court of Abundance. There is hardly anything more inspiring than to stand in any of the three courts and to look north through those well proportioned colonnades over the blue bay towards the purple foothills of Marin County, crowned by the graceful slopes of Mount Tamalpais on one side and the many islands of the bay on the other. It is surprising into how many enchanting vistas the whole arrangement resolves itself. For the city-planner the Exposition contains a wonderful lesson. What fine cities we might

have if some artistic control could be exercised over the buildings which are to stand opposite the junction of one street with another, not only at right angles, but also at lesser degrees—for instance, in all cases of streets running into Market street from the northwest.

To point out some particularly fine vistas, among many, we should mention that from the Orchestral Niche in the Court of the Four Sea-



DETAIL OF COLONNADE, PALACE OF FINE ARTS.

sons, looking toward the bay, or from the same court toward the Fine Arts Palace—and many more. The natural background seems to have been considered always, even in the arrangements of the smallest apertures. One should not overlook the two open courts which run off the main avenue, like charming coves in an island, into the main group of buildings, connecting at their ends with the Court of the Four

Seasons at the west and the Court of Abundance toward the east. These two, the Court of Palms and the Court of Flowers, have not so much the charm of seclusion of the more centrally located courts, but their architecture makes them of great interest.

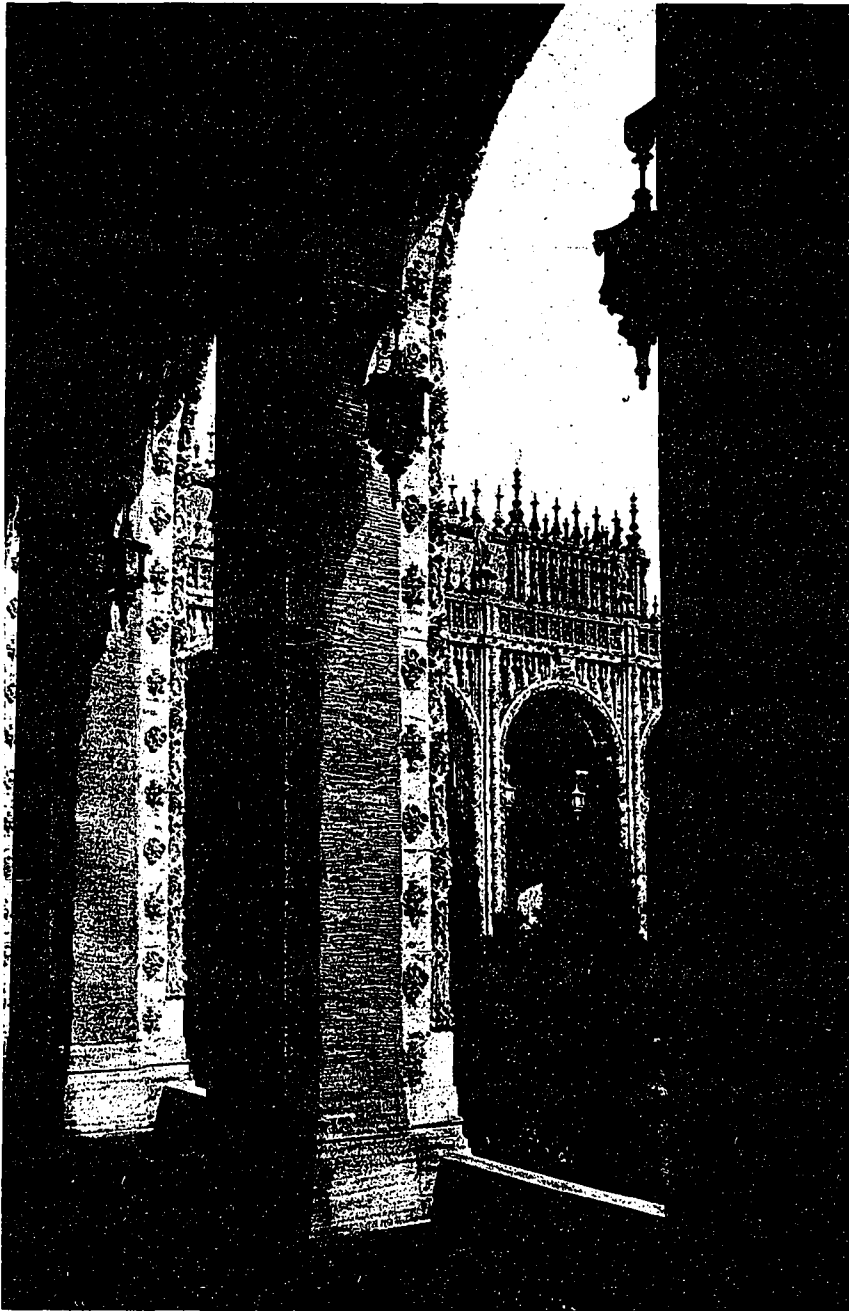
As to the style of the architecture of the main group of eight buildings, it has been called classic. If one means by that something excellent, something in good taste, we must admit that it is classic indeed. However, on closer examination it becomes very evident that the individuality of many men has found expression in the architectural structural forms, as well as in the minor and decorative forms.

The main Tower of Jewels, by Carrere and Hastings, marking the centre of the whole scheme, has a distinct character of its own.

There is no doubt that it is effective, but while its chief merit lies in its colossal proportions and its relative position, I feel that it lacks that oneness of conception that characterizes almost every other architectural unit in the Exposition. One feels too much the stacking up of storey after storey, that effort to fill the requirements of a given great height, very much as a boy sets up blocks of diminishing size, one on top of the other, until he can go no further because there are no smaller blocks. The whole effect of the tower is too static. Of its architectural motives, almost too many seem devoid of much interest, and like the column motive, repeated too often. The very effective and decorative employment of "jewels" tends to loosen up and enliven the structure very much. On a sunny day the effect is dazzling and joyous. The

tower has a feeling of dignity and grandeur, commensurate with its scale and setting. However, its great height is not apparent, owing largely to its breadth of base. The Sather Campanile in Berkeley looks higher, though it is actually one hundred and thirty-three feet lower. The side towers at the entrance of the Court of Palms and the Court of Flowers, while not so imaginative as the main tower, are far more sky-reaching. As towers go, John Galen Howard's tower at the Buffalo Exposition in 1901 stands unsurpassed in every way as an exposition tower.

The main Court of Honor, or Court of the Universe, as it is also called, designed by McKim, Mead & White, impresses by its tremendous dimensions, which operate somewhat against its proper enjoyment. I believe that the court is too large—so many things are lost in it, and it does not convey the quality of shelter that the two lesser courts possess in such marked degree. The Court of the Universe will never be the resting place of the masses of the people, in spite of the recently added attraction of the band stand, a mixture of Roman and Arabic architecture out of keeping with the surroundings. The conventional architectural motives of this great court do not help very much in tempting one to stay, and if it were not for the great arches on the east and west



VIEW INTO THE COURT OF ABUNDANCE.

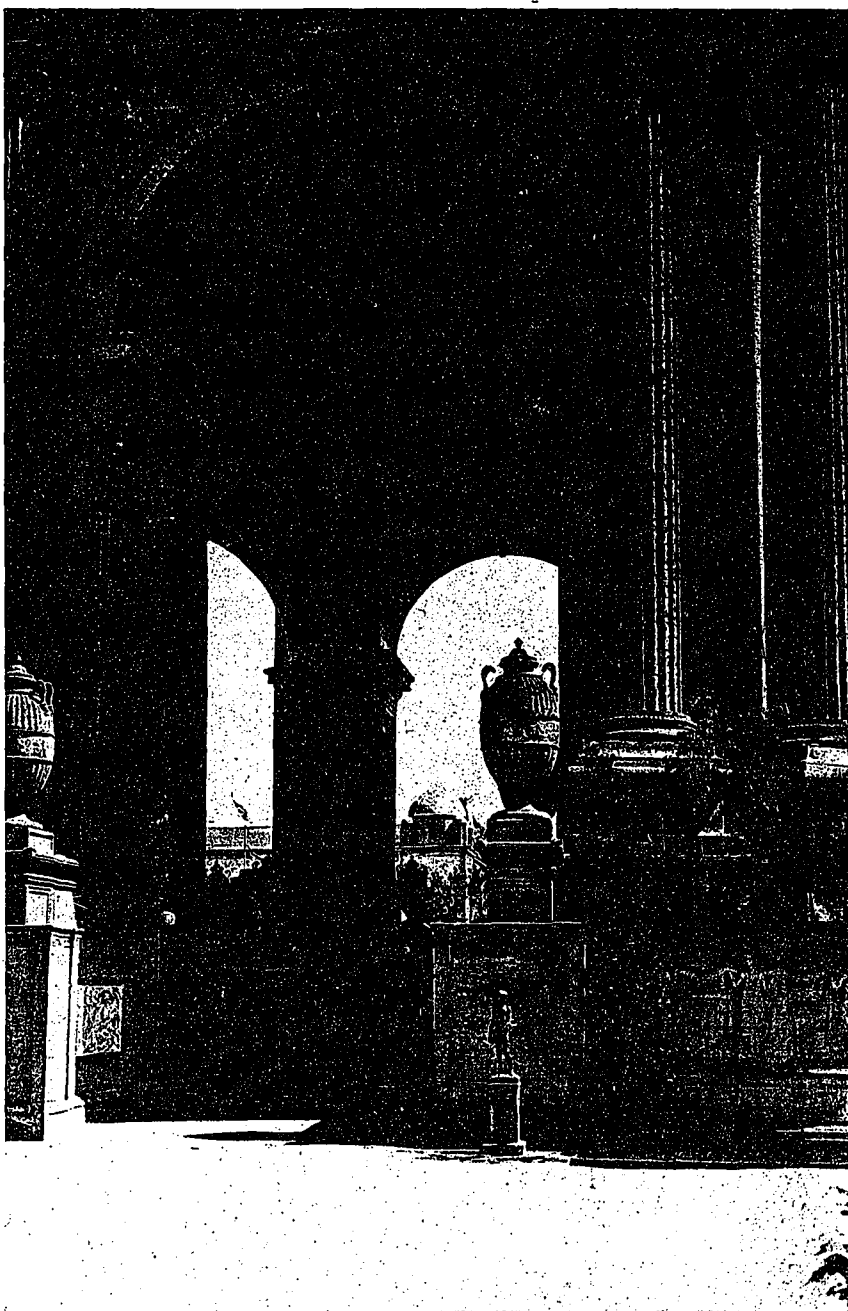
and the very fine view toward the Column of

Progress, I would feel tempted to classify it as a piece of architectural design of the stereotyped variety. It has all the great qualities and faults of the court in front of St. Peter's in Rome. There is too little play of landscape gardening in and near the Court of the Universe, a condition which will remedy itself with the breaking into bloom of the great masses of rhododendron which have been installed in the sunken garden in the centre.

Like all careful interpretations in the classic architectural traditions, the Court of the Universe has a great feeling of dignity and grandeur, which gives the visitor a feeling of the big scale of the rest of the architecture. The court lacks, however, the individual note of the two side courts.

Toward the west, passing through a very characteristic avenue, in the style of the happiest phases of the Italian Renaissance to be found in Florence, one enters the Court of the Four Seasons, by Henry Bacon of New York. The chief quality of this court is that of intimacy. While by no means so original as the Court of Abundance, it has a charm all of its own, in spite of its conventional architectural characteristics, which are really not different from those of the main Court of Honor. However, a very happy combination of gardening effects and architecture, together with the interesting wall-fountains, screened by stately rows of columns, makes for a picture of great loveliness. Of all the courts, it has the most inviting feeling of seclusion. The plain body of water in the centre, without statuary of any kind, is most effective as a mirror reflecting the play of lights and shadows, which are so important an asset in this enchanting retreat. During the Exposition it will serve as a recreation centre for many people who will linger in the seclusion of the groups of shrubbery and watch the shadows of the afternoon sun creep slowly up the surrounding walls.

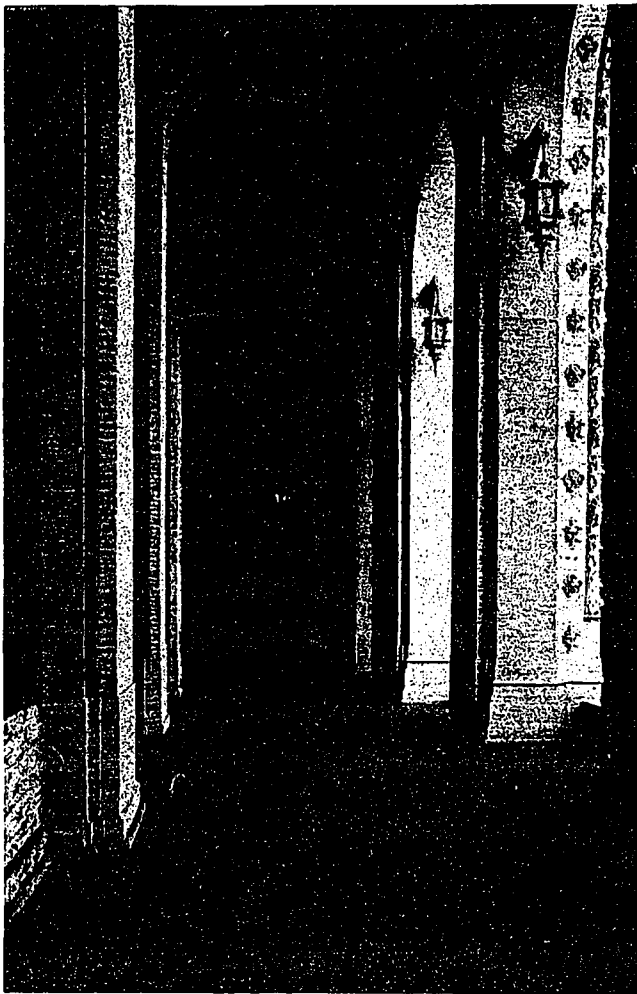
As an Exposition feature, the Court of the Four Seasons is a decided innovation. At St. Louis, for instance, in 1904, everything seemed to have been done to excite, to over-stimulate, to develop a craving for something new, to make one look for the next thing. Here, in the Court



ROTUNDA, PALACE OF FINE ARTS.

of the Four Seasons, one wants to stay. Most emphatically one wants to rest for a while and give one's self over entirely to that feeling of liberation that one experiences in a church, in the forest, or out on the ocean. I could stay in this court forever. To wander into this Court of the Four Seasons from any one of the many approaches is equally satisfactory, and it will prove a very popular and successful Exposition innovation.

Speaking of the courts, one is bound to yield to the individual note of Louis Mullgardt's Court of Abundance, on the east of the Court of the Universe. Of all the courts it has, without a doubt, the strongest individual note. It seems on first acquaintance to be reminiscent of the Gothic, of which it has, no doubt, the quality of lightness, the laciness, and the play of many



PROMENADE, COURT OF ABUNDANCE.

fine apertures and openings. It has, however, neither the Gothic arch nor the buttresses of that period, and so far as its ground plan goes, it is thoroughly original. It looks as if carved out of a solid block of stone. This monolithic quality is particularly well brought out in the tower on the north. While not quite so intimate as the Court of the Four Seasons, it conveys a feeling of shelter and seclusion very well by showing an uninterrupted wall motive on all sides. The sculpture symbolism of this court is particularly fine. We shall return to it in a consideration of sculpture.

The two minor courts by George Kelham are particularly fortunate in their open location toward the south. Their sheltered and warm atmosphere is quite in keeping with the suggestion of Spanish Renaissance which has been employed in the constructive and in the many decorative motives. The western court, or Court of Palms, is made particularly attractive by a sunken garden effect and pool. The effect of the Court of Flowers is similar in every way to its mate on the east.

A consideration of these two courts, with their towers, leads easily into a study of the outer facade, which, so to speak, ties all of the eight palaces together into a compact, snug ar-

angement, so typical of the Panama Exposition.

Bliss & Faville, of San Francisco, are responsible for the very skilful use of simple, plain surfaces, accentuated and relieved here and there by ornate doorways, wall-fountains, niches and half-domes. On the south, along the Avenue of Palms, are found some very fine adaptations of old Spanish doorways, which deserve to be preserved. It is regrettable that we have no large museum on the coast where these fine doorways in the outer walls of the Palace of Varied Industries could be preserved permanently. The travertine marble has nowhere been used more effectively than in just such details. The entrance of the Palace of Education at the western end of the south facade is also of great beauty of design.

On the western end two huge niches or half-domes command attention by their noble beauty and fine setting amidst great clumps of eucalyptus. On the north, no special effort has been made. There is, however, a decorative emphasis of the doorways along the entire front. On the east, facing the Palace of Machinery, some very fine doorways, very much like some of the minor ones on the south, furnish the decoration. It was no small task to bridge the many diversified architectural motives which penetrate into the outer wall from within, in the shape of many avenues and courts, and one can appreciate the difficulties of the designer who met so well these conflicting requirements.

Of the detached palaces outside of the eight forming the rectangular block nucleus, the Palace of Machinery attracts by its enormous



PORTAL, VARIED INDUSTRIES PALACE.



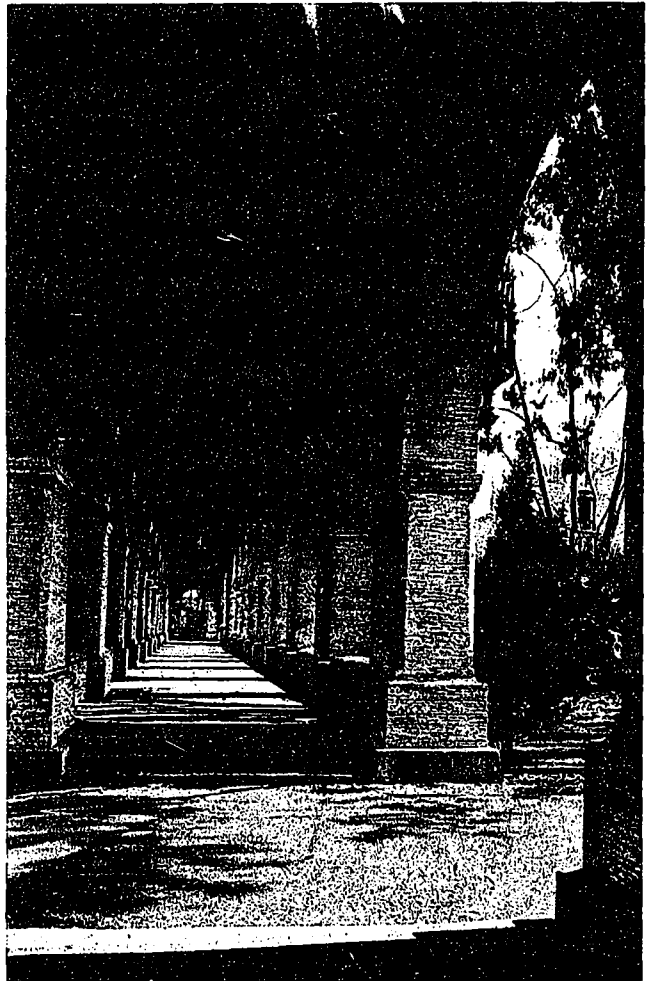
JEWELLED TOWER FROM SOUTH GARDENS.

size. I am not interested in how many kegs of nails and iron bolts and washers went into its anatomy. They add nothing to the artistic enjoyment of this very massive building. One point, however, in connection with the liberal use of the raw material is of artistic significance, and that is that the internal structural aspects of this great palace, as well as of the others, are not without charm and interest. It is only in recent years, and particularly in America, that the engineer has dared to invade the realm of the artist by attempting to make the constructive, anatomical material, like uprights, bracings, trusses, and beams, assume artistic responsibilities. It has been for many years the custom to expect the engineer to do his share in obscurity with the idea that it ultimately will be covered up by the work of the architect. The extraordinary development of engineering in this country, to meet new and original problems, sometimes of colossal proportions, particularly in the field of concrete design, has resulted in some conditions heretofore entirely unknown. I feel with much satisfaction that the unobscured appearance of the wood construction in the Palace of Machinery is very pleasing, owing to its sound constructive elements, as well as to a very fine regard for pattern-making in the placing of the bolts and braces. Here we discover the engineer in the role of the artist, which he seems to enjoy, and which offers endless new opportunities, particularly in the field of concrete construction, as well as in wood. The great size of the Machinery Palace is much more enjoyable from within, on account of the constructive patterns left in the raw, than from

without, where there is not enough animation in the many plain surfaces of the outer walls. I do not know that it is customary to put the engineer's name, together with that of the architect, on a building; the time is approaching very rapidly when we shall be in duty bound to do so.

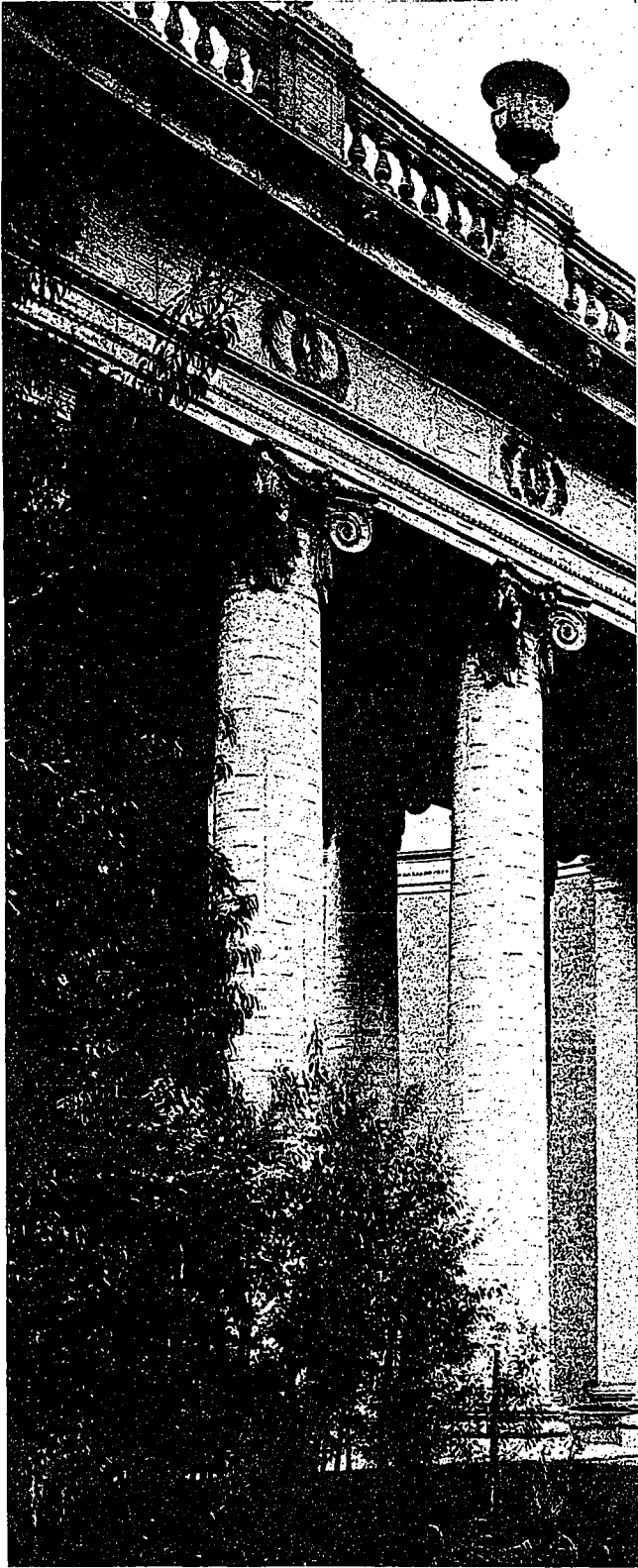
Aside from the structural charm of the inside, the outer facade of Machinery Hall is not entirely devoid of architectural interest. Its general forms are apparently those of an early Christian church, although its decorative motives are all indicative of the profane purposes for which it is used.

Festival Hall, by Farquhar, of Los Angeles, at the east end of the south gardens, does not look particularly festive, and it is not original enough to shine by itself, like its very happy mate at the south end, the Horticultural Palace. There is nothing like this Horticultural Palace anywhere on the grounds in its gorgeous richness of decorative adornment. It has no relation to any other building on the site. It is very happy, with its many joyous garlands, flower-baskets, and suggestions of horticultural forms—all very well done—so very much better done than so many of the cheap period imitations so common to our residence districts. It is so de-



CORRIDOR, CALIFORNIA BUILDING.

cidedly joyous in character that people looking for Festival Hall wander over to the Horticultural Palace, attracted by the very joyousness of its scheme.



DETAIL OF COLONNADE.

Good rococo ornamentation is rare abroad and even rarer in this country, which is essentially opposed in its tendencies and in its civilization to those luxurious days of the French kings who created the conditions under which

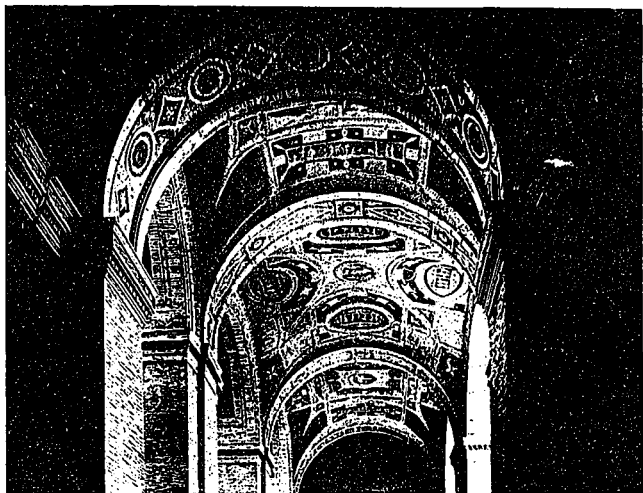
this very delightful style could flourish.

The Horticultural Palace is a great success as an interpretation of a style which rarely finds a sympathetic expression in this country. I do not feel at all that it ought, but in a case of this kind where a temporary purpose existed, it was happily chosen.

Of all isolated units, none causes greater admiration than the Fine Arts Palace. It presents the astounding spectacle of a building which violates the architectural conventions on more than one occasion, and in spite of it, or possibly for that very reason, it has a note of originality that is most conspicuous. Everybody admits that it is most beautiful, and very few seem to know just how this was accomplished. Many of the "small fry" of the architectural profession enjoy themselves in picking out its faults, which are really, as suggested above, the reason for its supreme beauty. Save for Mullgardt's court, it is the only building that seems to be based on the realization of a dream of a true artistic conception. With many other of the buildings one feels the process of their creation in the time-honored, pedantic way. They are paper-designed by the mechanical application of the "T" square and the triangle. They do not show the advantage of having been experienced as a vision.

With Bernard Maybeck's Palace of Fine Arts, one has the feeling that this great temple is a realized dream; that it was imagined irrespective of time, cost, or demand. Like all of Maybeck's buildings, it is thoroughly original. Of course the setting contributes much to the picturesque effect, but aside from that, the colonnades and the octagonal dome in the centre of the semi-circular embracing form of the main building present many interesting features. There is a very fine development of vistas, which are so provided as to present different parts of the building in many ever-changing aspects. On entering the outer colonnade one forgets the proximity of everyday things; one is immediately in an atmosphere of religious devotion, which finds its noblest expression in that delicate shrine of worship, by Ralph Stackpole, beneath the dome. This spiritual quality puts the visitor into the proper frame of mind for the enjoyment of the other offerings of art within the building. Mr. Maybeck has demonstrated once again that his talent is equal to any task in the field of architectural art. I wish we had more of his rare kind and more people to do justice to his genius.

Not far from the Palace of Fine Arts, on the shores of the bay, the monumental tower of the California building fits well into the scheme of things. Seen from a distance, from numerous points across the lagoon, it offers a great many effective compositions in connection with some



CEILING TREATMENT OF ARCADES.

very decorative groups of old acacia trees, the legacy of an old amusement park of the bygone days of San Francisco—the old Harbor View Gardens. In the shade of these old trees a fine old formal garden of exquisite charm, screened from the eyes of the intruder by an old clipped Monterey cypress hedge, really constitutes the unique note of this typically Mission building. The architect, Mr. Burditt, deserves great credit for an unusually respectful treatment of a very fine architectural asset. This very enchanting old flower garden, with its sundial and cozy nooks, has an intimate feeling throughout, and it furnishes the delightful, suggestive note of old age, of historical interest, without which it would never have been convincing.

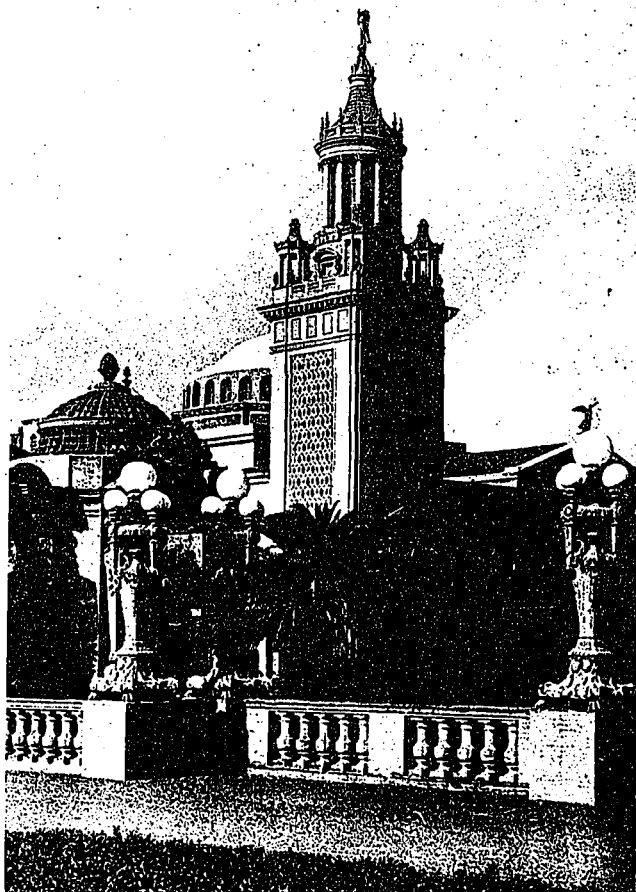
Aside from the outdoor features, the building, exclusive of the county annex, discloses a very fine talent in a very happy combination of classic tradition and modern tendencies. The building is altogether very successful, in a style which is so much made use of but which is really devoid of any distinct artistic merit. Most of the examples of the so-called "Mission style" in California are very uninteresting in their decorative motives, however big their ground plans may be in their liberal use of space.

The Oregon building is just across the way from the California building, and as an object of artistic analysis it is a most interesting single unit. Personally, I am not enthusiastic over it. It was most decidedly a very illogical idea to select a building to represent Oregon from a country which has nothing whatever in common with this northern State. One could hardly discover a more arid country, devoid of vegetation, particularly of trees, than Greece; and to compare it with the apparently inexhaustible wealth of virgin forests of Oregon makes the contrast almost grotesque. Besides, a building like the Parthenon, designed to grace and terminate the top of a hill, is surely not adapted for a flat piece of ground like the Exposition field. And in the choice of material used

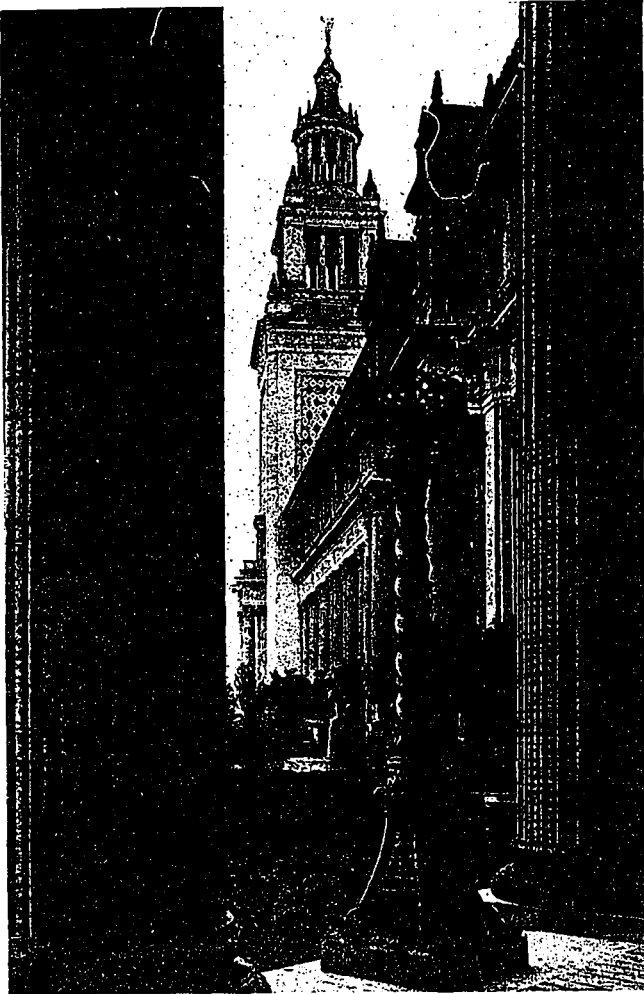
in its construction it shows a lack of appreciation for the fitness of things generally. The Parthenon was designed to be made in stone, as much for the construction as for the light color effect of the marble. Only the light color play of its exterior would do against a placid blue sky to relieve the otherwise exceedingly simple rigidity of its massive forms of construction. To make an imitation of this great building in uncouth, sombre, almost black pine logs of dubious proportions is hardly an artistically inspired accomplishment.

There must always be a certain regard for the use of the right material in the right place. A wooden bridge will disclose its material even to the uninitiated at a very great distance, because everybody knows that certain things can be done only in wood. A stone, concrete, iron, or cable bridge, for example, will each always look its part, out of sheer material and structural necessity. A log house would have been far better and more successful than this pseudo Parthenon. It is in the same class with the statues of Liberty made from walnuts that are the great attractions in our autumnal agricultural shows. The State of Oregon, however, is well represented by a fine, immense flagpole, which could hardly have been cut anywhere else than on the Pacific Coast.

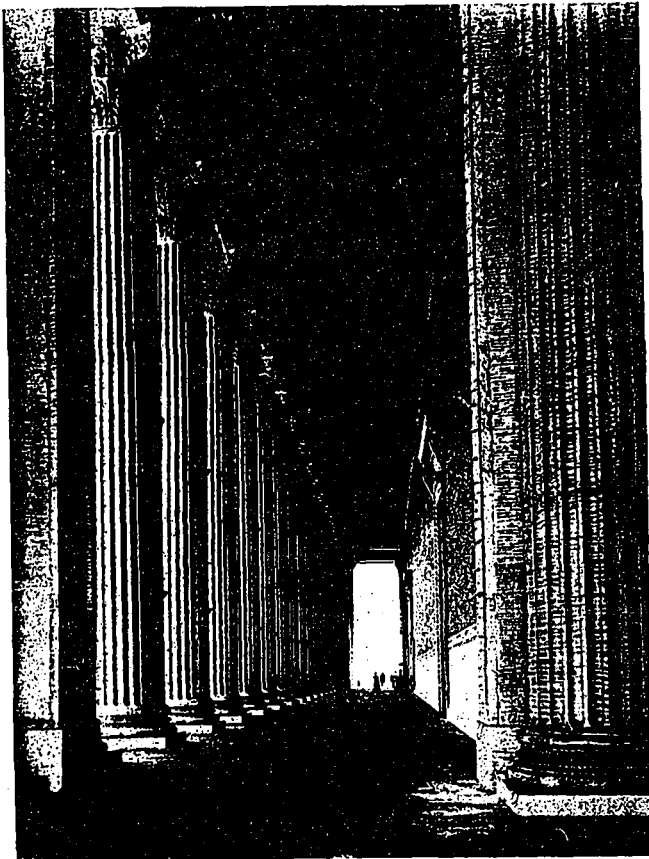
Of other State buildings in this neighbor-



ITALIAN TOWER, FROM SOUTH GARDENS.



LOOKING INTO COURT OF FLOWERS.



PROMENADE, PALACE OF AGRICULTURE.

hood, a number are impressive by their cost, like the New York building; others, again, by historical suggestions of great charm. There are several which reflect in a very interesting way the colonial days of early American history; and buildings like those of New Jersey and Virginia, in spite of their unpretentiousness, are very successful. Nobody would take them for anything else but what they represent.

The Pennsylvania building shows a very fine combination of the classic and of the modern. It was originally designed to hold the Liberty Bell. In order to avoid the necessity of building a fireproof building, the open hall was adopted, with its inviting spaciousness, and two lower enclosing wings at the side. The arrangement of the Pennsylvania building is formal, owing to its symmetry, but not at all heavy. Its decorative detail is full of interest, and to discover Hornbostel of New York, the designer of the Oakland City Hall, as the author of this building, is a pleasant surprise.

Nothing excites the Exposition visitor more than the color scheme of the buildings. But "excite" is really not the proper word, because there is nothing exciting about it. Nothing was farther from Mr. Guerin's mind than to create excitement, unrest, or any of those sensations that might lead to fatigue or even to a nervous breakdown. We understand fully by this time that it was Jules Guerin who is the responsible artist, and who supervised the putting into existence of the first real "Guerin" that ever was. Mr. Guerin has the distinction of being the first director of color and of decoration ever appointed for an International Exposition.

It must become evident to any person who is at all familiar with the fascinating tonal designs Guerin produces for many of our leading magazines that what he did was nothing but to paint nature as he has been used to represent it in his pictures. Guerin must have had a glorious time with that first great opportunity, so seldom to happen, of putting all those pet colors of his into the actual outdoors, there to feast his eyes upon them. It was a daring and novel undertaking, most successful in a large way. I hope we are going to benefit by this successful experiment and begin to give life to our dreary cement facades, mournful roofs, and lifeless window-sashes, ornamentations, and what not. We are, I admit, hopelessly at the mercy of the house-painter, who knows much about estimates, something about paint, and little about color. I hope we are going to learn the difference between paint and color, the purely physical, meaningless thing on the one hand, and the intelligence-conveying, pleasure-giving element on the other.

Guerin certainly knows color, and I take it

for granted that a man of his training and experience knows how to use paint. His Exposition buildings look for all the world like a live Guerin print taken from the "Century Magazine" and put down alongside of the bay which seems to have responded, as have the other natural assets, for a blending of the entire creation into one harmonious unit. I fancy such a thing was possible only in California, where natural conditions invite such a technical and artistic innovation.

The general effect is one of great warmth! The basic tone of the travertine furnishes a very rich foundation for the other colors added. The whole range of color is very simple, and it is simplicity and repetition over large areas that make the colors so effective. There are three different greens, for instance—the patina green on many minor domes, suggesting aged copper surfaces; a very strong primary green, on the small doors of the palaces and most of the lattice work; and another very pale, pinkish green, a sort of an abalone shell green, used on all the flagpole bases, always topped off with a light pinkish red, used above the light green base on all the flagpoles.

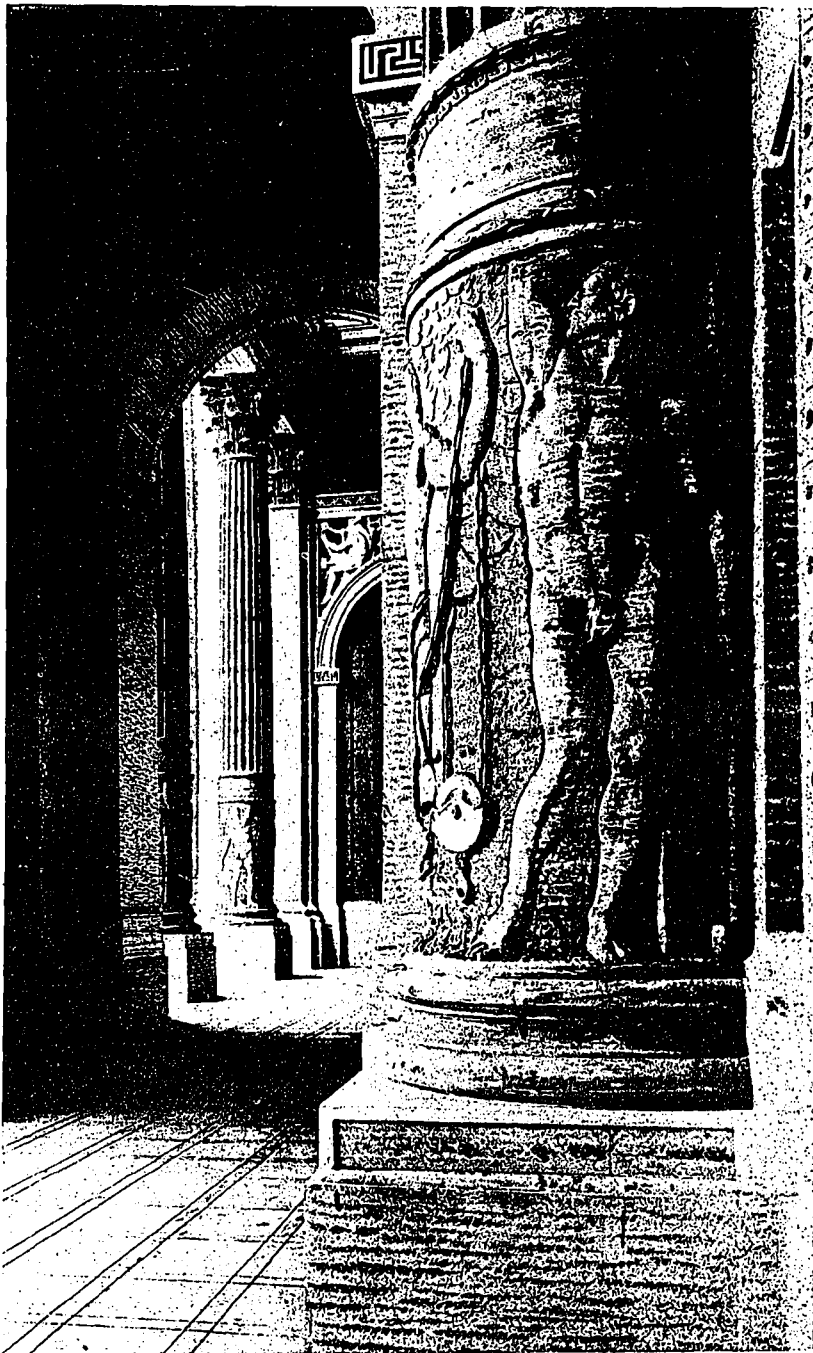
Then there are the reds, a number of different reds, running from a pinkish brick color to a darker russet red, to be found exclusively in all vertical panels serving as background for detailed statuary—for instance, in all the courts. Next to the red there is a brilliant orange, used in relatively small quantities here and there in the mouldings, as around the Brangwyn paintings in the Court of Abundance.

This leaves yet to be named the few soothing blues that abound in the ceilings, in the deep recesses of the walls, and the coffered arches, serving as backgrounds for the many richly-modeled terra cotta rosettes.

This is practically the entire range of colors, but they assume, of course, endless variations of tone and intensity, owing to the difference of the surfaces and the play of light and shadow. The relation of the whole color scheme to the colors furnished by nature is by no means accidental. The effect of the ensemble, on a calm, sunny day, is hard to describe in its gorgeous beauty.

The pressing into service of nature as applied

to color was particularly inviting, of course, on the bay side, where simple sweeps of skies, foothills, and plain bodies of water furnish almost ideal conditions. This is true in a similar way for the background in the west, but toward the south—well, we had better forget such mournful outward aspects of our great city of San



VESTIBULE DETAIL, PALACE OF MACHINERY.

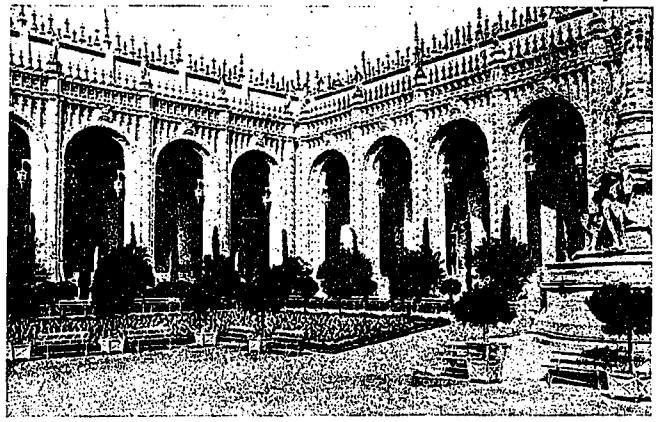
Francisco, known around the world for its gay temperament.

Appreciating the importance of detail, Guerin extended his color treatment to practically everything presenting surface. Nothing could escape his vigilant eye. Even the sand covering of the asphalted roads is of a peculiarly attractive blend. It seems like a mixture of ordinary sand with a touch of cinnamon. Even that corps

of stalwart guards had to submit to a tonal harmony of drabs, with touches of yellow metal, warm red puttees, and neat little yellow Spanish canes. They all seem very proud and appreciative of their part in the concert of colors, and they speak of it with feeling and reverence. Not long ago, during a rather stormy, wet day, I happened to notice several of these cicerones hiding in a doorway of one of the palaces, looking most disconsolate. The reason for it became immediately apparent; the un-Californian weather had forced them to put on civilian overcoats of indescribable hues, and the shame of being out of color was plainly written in their faces. It shows that art is largely a matter of education.

I fancy that all that a respectful and appreciative public could do, in order to live up to the occasion, would be to have Exposition suits built of pongee silk, or some other harmonious material. So far, on all of my visits, I observed a shocking preponderance of black, which I hope will eventually yield to the softer colors of lighter materials, with the arrival of warmer weather.

The careful observer will find that the crimson vermilion red of the fire alarm boxes had to yield to a more refined vivid orange, much, I



COURT OF ABUNDANCE.

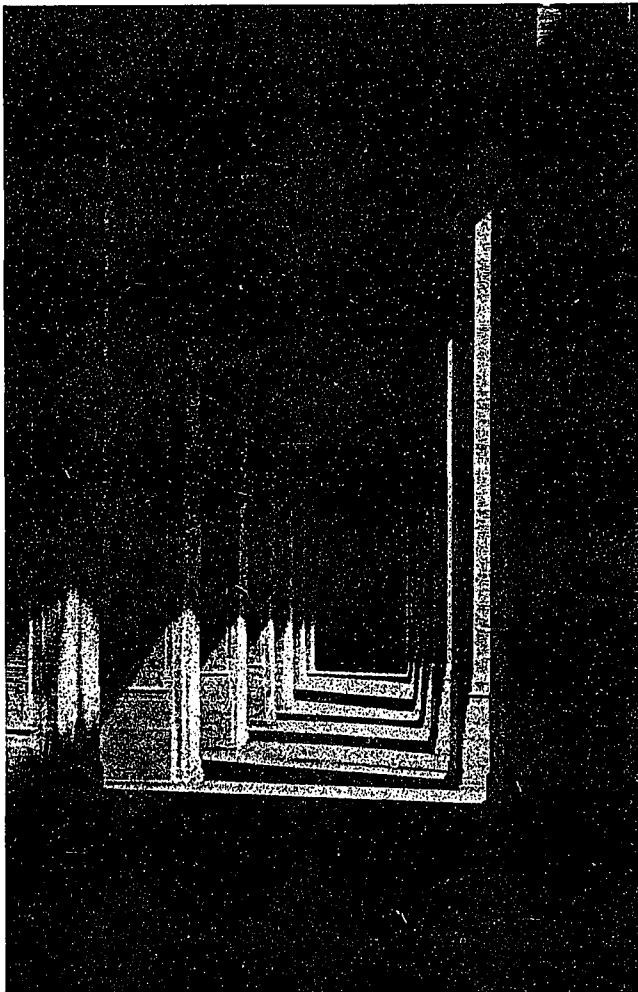
understand, to the consternation of the Exposition fire marshal, who must have been shocked at this intrusion.

The horticultural effect of the grounds, flower beds and shrubbery will always adapt itself properly to the color scheme, and a preponderance of warm yellows, reds and orange will simultaneously fill out the garden areas. At first yellow pansies and daffodils had control, to be replaced in due season by the uniform appearance of tulips, hyacinths and successions of other flowers. This progressive appearance of new flower carpets will provide ever-changing elements of interest throughout the entire period of the Exposition.

It seems only right at this time to speak of the great and modestly contributed services of John McLaren. He, with his wide experience and unceasing energy, created the garden setting which ties all the buildings into a natural harmony. Hardly ever have trees, shrubs and flowers been used in such profusion in an exposition. Conventional in aspect, all great expositions in the past have been lacking in the invigorating elements, no matter how naturalistic the site may have been. The few scraggly pines of St. Louis looked more like undesirable left-overs of a former forest than like a supporting feature of the Exposition picture.

The stony look of many former expositions is not evident at San Francisco. Considering the fact that the Exposition is largely on made ground, it is amazing what has been accomplished. With the exception of the few scattered remains of an old amusement park—the Harbor View Gardens—so charmingly utilized in the courtyard of the California building, practically all the trees and shrubs had to be brought in from the outside, whole gardens being moved by Mr. McLaren "en bloc."

Like everything else, from the architecture down, the garden aspect of the Exposition is not frugal nor skimpy, whatever floral effects are used. Like shrubbery, trees occur in great profusion, and without regard for difficulties in transplanting.



ARCADED PROMENADE.

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A. H. McPHAIL, formerly of Sault Ste. Marie, Ontario, and Irvin S. F. Walker, of Walkerville, have formed a co-partnership for the practice of architecture, and will be located at 48 Ouellette avenue, Windsor, Canada. Catalogues and manufacturers' supplies solicited.

* * *

THE LAYING of the foundation stone of the new union station at Quebec, August 12, marked a new epoch in the history of the ancient capital. The ceremony was performed by Mayor Drouin, and was witnessed by a large gathering including the Lieutenant-Governor and Mrs. Leblanc, Premier Gouin, many public men and a number of Canadian Pacific Railway officials, prominent among them being F. L. Wanklyn, of Montreal, and H. V. Mapes, C.P.R. engineer of buildings. Mr. Wanklyn said that the Canadian Pacific Railway was looking towards the future in this matter, assured that the progress of the port of Quebec demanded the most serious consideration, so far as it was a question of passenger terminus.

THERE has been a curious result of one of the fires caused by suffragets in 1914. The fire in question practically destroyed the historic Church of St. Mary at Wargrave, near Henley, which, among other interesting objects, contained the tomb of Thomas Day, the author. In the restoration it was found that the present casing of red brick is only a covering for the original Norman tower. The latter proves to be a very fine example of Norman architecture—one of the best, in the opinion of experts, existing in England. When the tower was cased with red brick is a mystery, but the work was probably done in the reign of Henry VII., or that of Henry VIII. Among other discoveries made as a result of the performance of the suffragette "arson squad" are a number of vaults under the chancel, of which no one had guessed the existence.

* * *

GRADUALLY the profession of architecture is assuming a standing similar to that of the lawyer, clergyman and physician. Two recent legislative acts happening in sections quite distant from each other indicate, to a large extent, the general attitude towards the registration of architects. During the last session of the Legislature the following amendment to the Act incorporating the Saskatchewan Association of Architects was passed, which is undoubtedly one of the most restrictive measures on the statutes of any province in Canada, and prohibits unqualified persons from practising architecture in Saskatchewan: "Any person who, not being an architect and registered under this Act, supplies, for hire, gain, or hope of reward, plans, blueprints or specifications for use in the erection, enlargement or alteration of any building not being built for himself or by himself as contractor for another person, shall be liable on summary conviction to a fine not exceeding twenty-five dollars for the first offence, and not exceeding one hundred dollars for every subsequent offence; and he shall be incapable of recovering any reward or disbursements on account thereof." The other is an amendment to the law of New York State, entitled "A law relating to general business." Here the section provides that a citizen twenty-one years of age of good moral character may apply for examination or certificate of registration, but before securing such a certificate, he must have graduated from high school and completed the equivalent of two years of college. He must further have had five years' practical experience in the office or offices of a reputable architect or architects. Graduates of a recognized architectural school with three years' practical experience are all eligible for examination. It has taken nine years of continuous effort to secure the passage of this measure.

TWO VIEWS OF COMPETITIONS

Looked at broadly, a competition is a great waste of skilful effort. It is true the prize, or prizes, given may be of higher value than is the professional value of the individual design, or designs, to which they go. They never, or seldom, represent the professional value of all the designs submitted, and thus the client has received more than fair value for what he has given. He has called forth a large amount of work for his own benefit for which he has paid nothing, and which is worthless for any other purposes, and has thus been the cause of much wasted labor. The difference between a competition and a lottery is, after all, but small; in the second the stakes are in money, in the first they are in labor. It is true that the one is a gamble whose success depends on chance, the other is one whose success depends on skill; but there are elements which handicap the skill of some of the competitors, and there is an element of chance in the decision of those who select the prize winners. If, then, there are any advantages in architectural competitions, they lie on the side of those who invite them; but we are speaking on the side of the competitors, and in their interests we feel that it would be well if competitions were abolished. Nothing of the kind prevails in any other profession, except in a very limited way in engineering, and the architectural profession would gain in dignity if it proscribed them.—*Indian Engineering.*

Competition necessarily spurs a man to greater individual effort, and while it is expensive—to the loser, for sometimes a competitive design will cost as much as \$5,000—yet in the end the whole art and craft of architecture must benefit. The time seems to have come when an abandonment of the personal method of awarding design commissions will be reached. Necessarily this personal plan is rather limiting to the architect, for it tends to keep his work in a specific groove. The man who has designed a good church is likely to find himself receiving commissions for more churches, while the architect of a railway station, a library or a theatre will soon recognize that one task of this sort leads to another in the same field. Competition is likely to remove this and to broaden the whole field.—*Egerton Swartwout.*

* * *

THE CONSTRUCTION of the Exposition grounds and buildings at San Francisco, Cal., involved practically the design, construction and administrative organization for a complete, living city, at once idealistic in its architecture, for it had to represent the highest development of the art, and yet be severely practical in construction and management, for its space of life is very brief. The total construction cost amounted to \$14,500,000, one-half of which was

expended on buildings, and the balance on acquisition and preparation of site and supplying the engineering, sanitation, fire protection, water supply, heating, lighting, and other utility features. All this was accomplished within a space of three years and the result is the transformation of 625 acres of unimproved land (184 acres of which were marsh and tide land) into 641½ acres of main Exhibition palaces, 100 acres of growing gardens, trees, churbs and flowers, 15 miles of asphalted roads, and other improvements.

* * *

TO insure rapidity of construction of the Panama-Pacific Exposition buildings, and to simplify organization problems, all of the work susceptible of definite specifications was let by contract, and it required nearly 1,000 contracts, varying from nominal amounts to \$800,000.00. No body of men can appreciate what all this really meant better than the thousands of visiting builders who will, with their ladies, enjoy the enchanting scene by the Golden Gate in October next.

The main Exposition buildings, except a portion of the Palace of Fine Arts, the Tower of Jewels, and the great dome of the Horticulture building, were constructed on massive timber frames, and some idea may be obtained of their magnitude from the fact that this work involved the use of 80,000,000 feet B. M. of lumber, 80,000 lineal feet of two-inch hardwood pins, 6,200 tons of bolts, rods and plates, 3,500 tons of structural steel, 1,000 squares galvanized sheet metal, 920,000 square feet of glass, 18,000 tons hardwall plaster, 800,000 feet timber piling and 38,000 rolls prepared roofing.

* * *

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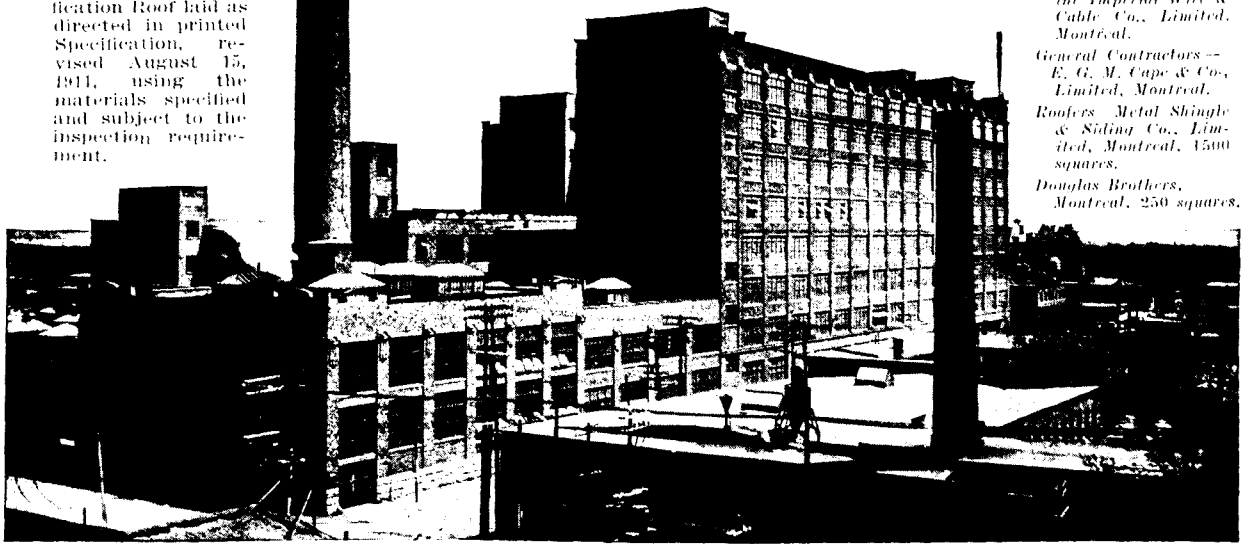
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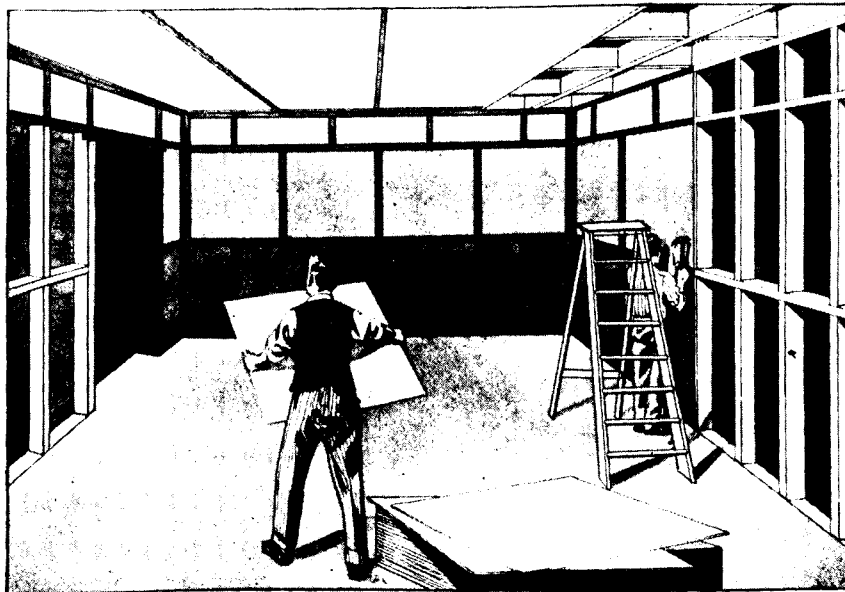
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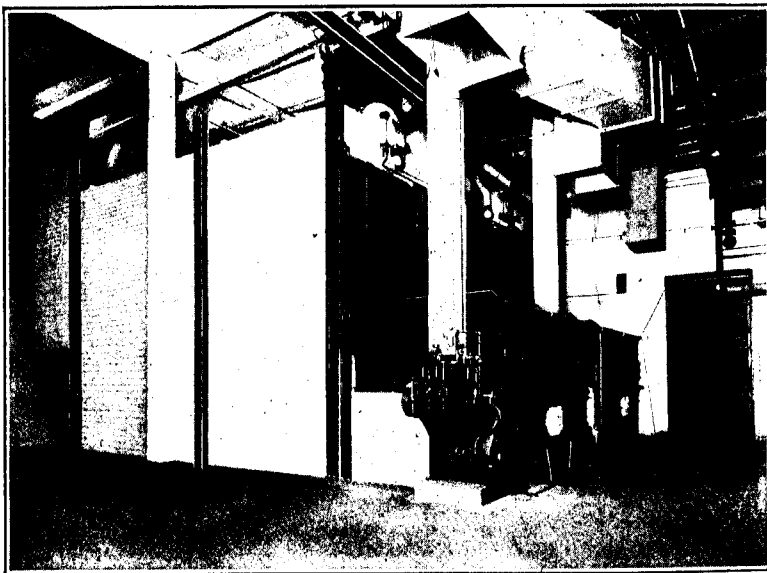
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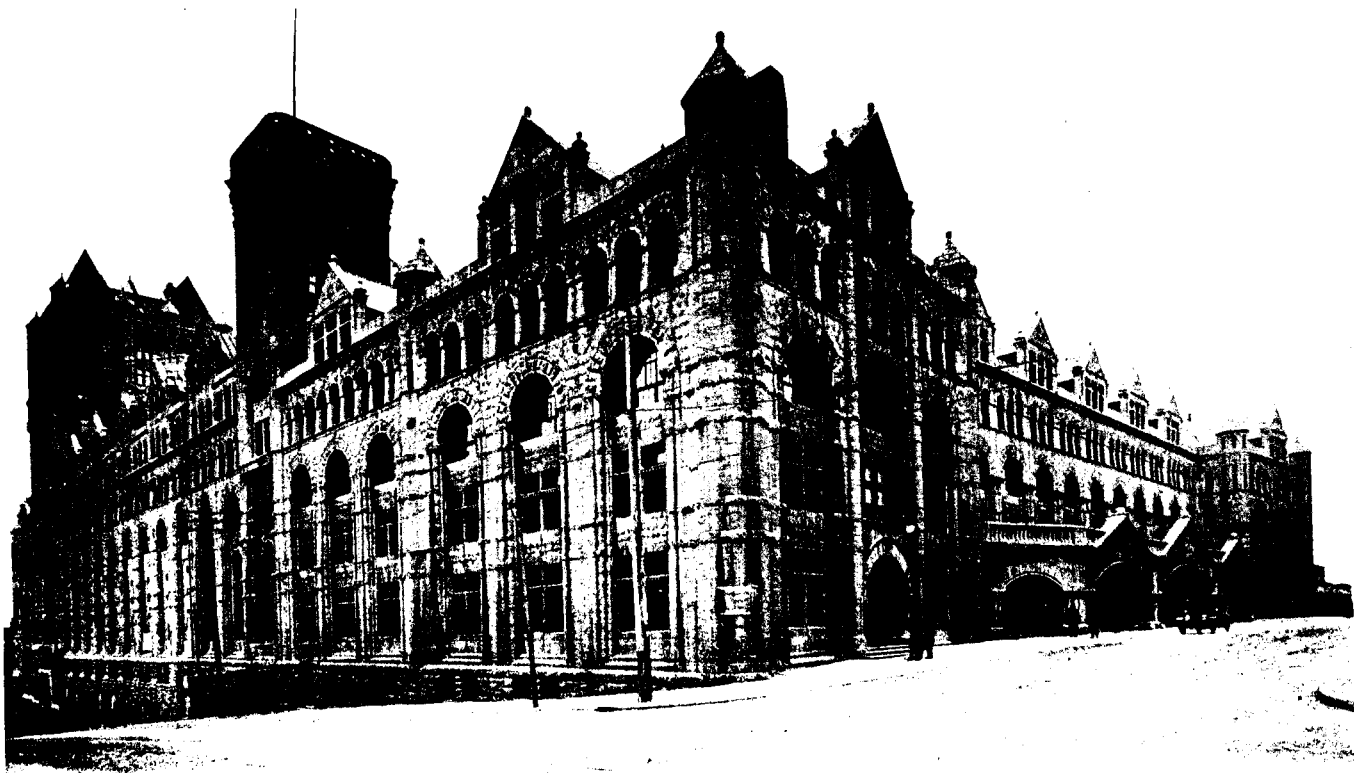
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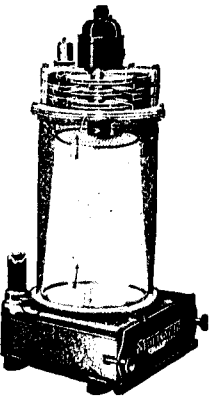
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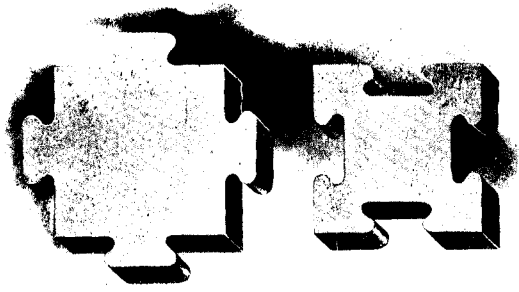
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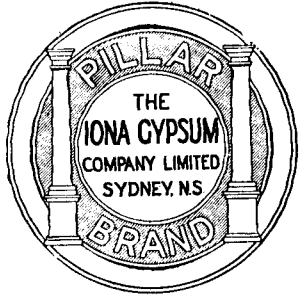
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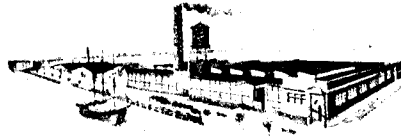
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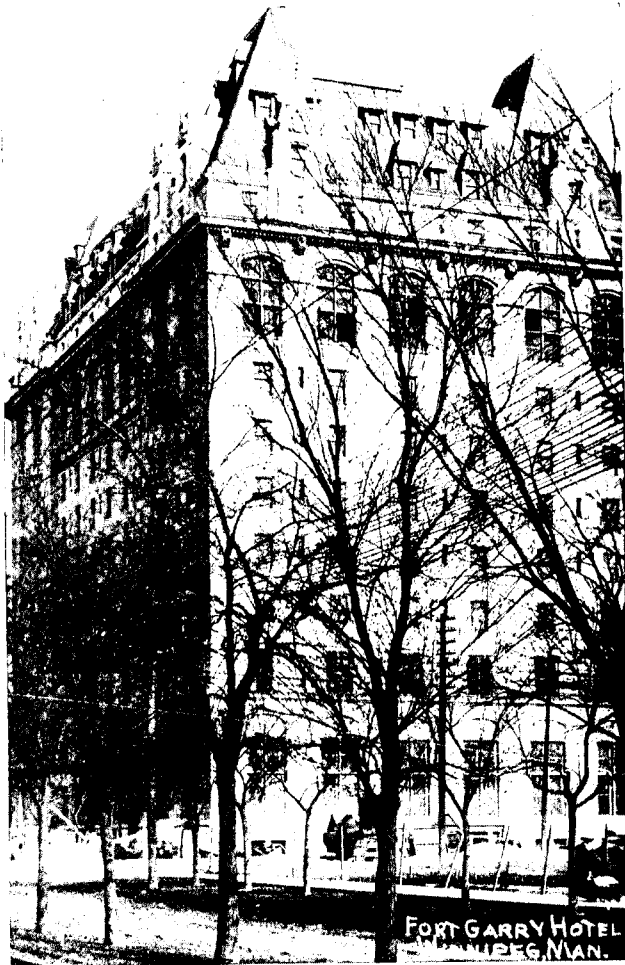
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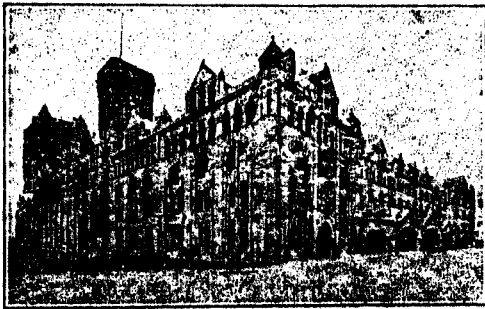
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